Book Reviews

T. H. Huxley, Scientist, Humanist and Educator. Cyril Bibby. Forewords by Sir Julian Huxley and by Aldous Huxley. Horizon Press, New York, 1960. xxii + 330 pp. Illus. $5.

Rarely does one find such a book as this. The outward signs proclaim a standard biography, but the volume is far from that, even though supplied with such scholarly appurtenances as biographical footnotes on every public figure named and impressive bibliographical citations of the original works, minutes, and letters pertaining to Thomas Henry Huxley. The treatment is definitely nonchronological, although to compensate for this the author has included a highly interesting tabular array of information at the end of the volume, in the form of a Conspectus of T. H. Huxley's Life and Times. Here, year by year throughout Huxley's life, one can note, in eight parallel columns, the chief events in British government and social, cultural, and educational background, as well as personal information, significant publications, selected lectures, and scientific society happenings.

What marks the book as distinctive —and indeed distinguished—is its point of view. Instead of attempting to look at the phenomenon of Thomas Henry Huxley in full, Cyril Bibby, himself a teacher and a teacher of teachers, has chosen to concentrate attention on Huxley's intense devotion to matters of education and his primacy in extending education in Britain to every child and in forcing upon a stagnant system of higher education some appreciation that the natural sciences must form a part of the liberal education due modern citizens. Everything else is peripheral and secondary in interest to this emphasis. Huxley the scientist, Huxley the humanist, and Huxley the family man yield place to Huxley the educator.

Cyril Bibby's style is readable and often graphic, and the portrait that results is as finely drawn as the lineaments of Huxley's changing features, which grace this book in the numerous photographs and drawings that represent him, seriously or in caricature, at various ages. Only two items are drawbacks: one, that the deliberate disregard of chronology makes one shift gears, with considerable grinding, at frequent intervals; the other, that in some chapters there is a plethora of British school jargon, such as "Responsions," "Moderations," "Tripos," "the Grace," and the like which may require some explanation for American and other foreign readers. These are quite minor matters compared to the merits of the book.

Huxley, the Educator

The first four chapters constitute a broad introduction to the educational theme. With "Science for the Citizen" we are fairly launched into an account of Huxley's absorption in active teaching and his promotion of better educational programs. Throughout Huxley's stout defense of Darwinism and his clash with the clergy, throughout his scientific labors and his political sallies, and throughout his concern with morality and metaphysics, these matters clearly remained the dominating activity to which his energies were directed. How he built the first School of Science in England, how almost singlehandedly he reformed the miserable state of secondary school education while serving on the London School Board, his influence on the British public schools, on the older English universities and on those of Scotland, culminating in his final stupendous struggle—when old and sick—to draw together the divided and substandard colleges of his city into the University of London—these narratives make a stirring tale for anyone convinced that education is a major problem of society.

Huxley's Concepts: Then and Now

To Thomas Henry Huxley we owe certain well-accepted ideas—the conviction that the ordinary workingman is often competent and eager to learn, and the emphasis on the laboratory as the basis of the best teaching in the sciences. But we also find him voicing revolutionary conceptions that even now need reemphasis. These include a redefinition of liberal education to include the sciences as a major, integral part of the education of every citizen living in an age indubitably transformed by scientific developments; the importance of the arts along with the sciences; the need for morality, integrity, and doubt to accompany will and intellect; and the right of every child to have educational opportunity in proportion to his capacity and willingness to learn. Those in government today who are considering broad educational programs in the sciences would do well to read Huxley on these subjects, for nearly a century ago he had grappled with most of these problems and reached sound conclusions.

Huxley's career was marked, as Bibby says, by extraordinary effectiveness. This was in part because he was a veritable "agnostic tornado of energy," able to work incessantly and at a dozen tasks at one time. It was also because he knew men—knew when to be stubborn and unrelenting and just when to concede a minor point in order to gain a major concession. And, of course, his effectiveness owed much to his great mastery of expression. Clarity and lucidity marked his prose, both spoken and written, and were matched by forcefulness. Although he respected sincerity, he tolerated no shoddy logic in himself or in others. The result was a hard-hitting eloquence that was as feared by Gladstone and Newman as by Bishop Wilberforce, by Richard Owen as by the Duke of Argyll. The temptation to quote some of his sayings about education is quite irresistible.

> Our sole chance of succeeding in a competition, which must constantly become more and more severe, is that our people will not only have the knowledge and the skill which are required, but that they shall have the will and the energy and the honesty, without which neither knowledge nor skill can be of any permanent avail.

> There are a great many people who imagine that elementary teaching might be properly carried out by teachers provided with only elementary knowledge. Let me assure you that this is the profoundest mistake in the world. There is nothing so difficult to do as to write a good elementary book, and there is nobody so hard to teach properly and well as people who know nothing about a subject.

> . . . nothing can now prevent it [scientific knowledge] from continuing to distil up-

wards and permeate English society, until, in the remote future, there shall be no member of the legislature who does not know as much of science as an elementary schoolboy.

. . . the great aim should be to teach only so much science as can be taught thoroughly; and to ground in principles and methods rather than to attempt to cover a large surface of details.

. . . in the actual condition of the nation . . . I cannot doubt the wisdom of enforcing the teaching of science upon the public schools by positive enactment.

If individuality has no play, society does not advance; if individuality breaks out of all bounds, society perishes.

No personal habit more surely degrades the conscience and the intellect than blind and unhesitating obedience to unlimited authority. Undoubtedly, harlotry and intemperance are sore evils, and starvation is hard to bear, or even to know of; but the prostitution of the mind, the soddening of the conscience, the dwarfing of manhood are worse calamities.

Let the reader decide which of these sayings are relevant to our own times and our present national condition.

Huxley's New World

The last chapter of the book is entitled "To the New World," but it includes more than a discussion of Huxley's trip to the United States and his address upon the occasion of the founding of the Johns Hopkins University. The chapter concludes with a broader consideration of the really "new world" which Huxley always had in mind as the fruition of his hopes and the goal of his efforts, a "new world" in which the scientific method would be supreme.

"We are in the case of Tarpeia," he declared on one occasion, "who opened the gates of the Roman citadel to the Sabines and was crushed by the weight of the reward bestowed upon her. It has become impossible for any man to keep pace with the progress of the whole of any important branch of science. It looks as if the scientific, like other revolutions, meant to devour its own children; as if the growth of science tended to overwhelm its votaries; as if the man of science of the future were condemned to diminish into a narrow specialist as time goes on."

Only by sharing the rewards might we escape Tarpeia's fate, only by so organizing and extending scientific education that breadth of culture might be secured without superficiality, depth and precision of knowledge without narrowness. To achieve this remains today, as in Huxley's time, the major task of education. What Huxley foresaw so clearly a century ago, we may all see clearly today as the imminent threat to further progress. Before addressing ourselves to this task, we might well reread Huxley on education, or, in lieu of that, peruse this farsighted, spirited book which for the first time treats adequately Huxley's dedication to science in education, and to education in science.

BENTLEY GLASS
Department of Biology,
Johns Hopkins University

Physics of the Upper Atmosphere. John A. Ratcliffe, Ed. Academic Press, New York, 1960. 586 pp. Illus. $14.50.

In the past 10 years our knowledge of the earth's upper atmosphere has gone forward to an extent unparalleled during any previous period. The subject matter has expanded greatly and now includes for the first time, information about the nature of the solar radiation that provides the driving force for so many atmospheric phenomena. The names of the topics are very much the same as they are in the classic treatise by Mitra, but the content is remarkably different. This is evidenced at once by the introduction by Sydney Chapman, a man who has contributed so outstandingly to every facet of the physics of the upper atmosphere, not to mention his many other contributions to pure physics. Here he views the problem of the interaction between the solar corona and the earth's outer atmosphere (the exosphere, and its ionized portion, the protosphere).

M. Nicolet of Belgium addresses himself to the problem of the distribution of atmospheric constituents in the ionospheric region. He gives an excellent general review of the whole atmosphere but then concentrates on such topics as the dissociation of molecular oxygen and the problem of diffusion. There is a particularly detailed discussion of the problem of heat flow in the upper atmosphere. Finally, satellite data are used to give information on the structure of the atmosphere up to about 700 kilometers.

The next chapter, by Homer E. Newell, Jr., is an authoritative review of data on the upper atmosphere obtained by rockets and satellites. The emphasis is on rockets, and most of the information deals with atmospheric structure, winds, and density of ionization. It is extremely useful to have this review which also incorporates data obtained during the International Geophysical Year.

In contrast to the wide scope of the previous chapter, Herbert Friedman's discussion of the sun's ionizing radiations is a detailed account of the state of our present knowledge of x-ray and ultraviolet radiation from the sun and of its interaction with the atmosphere. Most of the important research findings in this area have been made by Friedman and his colleagues at the Naval Research Laboratory.

The next three chapters, dealing with airglow and aurora, are written by David R. Bates of Belfast. The discussion is brief but quite complete. The spectrum intensities and excitation processes are discussed for the nightglow, the twilight glow, and some indication is given of the possibility of a day airglow. The chapters on the aurora again are brief but meaty. The auroral forms are classified; their geographic and temporal distribution is described, and their relation to other geophysical phenomena is shown. It is in the discussion of the auroral spectrum, however, that the author contributes important detail and much new material. The aurora is also described from the point of view of radar, with particular emphasis on the motions associated with auroral echoes, by Henry G. Booker.

The longest and most detailed chapter (318 references), by J. A. Ratcliffe and K. Weekes, discusses all phases of ionospheric physics. Only the subheadings need to be given, "Theory of the origin and shape of layers of electrons," "The ionosphere as a dynamo and a motor," "Theory of wave propagation through the ionosphere," "Undisturbed D-region," "Undisturbed E-layer," "Undisturbed F1-layer," "Undisturbed F2-layer," "The collision frequency of electrons," "Horizontal irregularities and movements," and finally "Disturbances and storms in the ionosphere."

Closely related is the chapter on upper atmosphere and geomagnetism by E. H. Vestine. Here the subject matter has not advanced as rapidly in the last few years. Much of our knowledge of the daily solar variation, and the daily lunar variation is as it was before the IGY. Magnetic storms have been better studied, however, and the subject of magnetic pulsations has come to the foreground. The puzzling