Current Science Reading

Kirtley F. Mather

Department of Geology and Geography, Harvard University, Cambridge, Massachusetts

AS USUAL AT THIS TIME OF THE YEAR, the array of recently published scientific literature is overwhelming in quantity, but sufficiently rich in quality and adequately diversified in content to satisfy the needs of the most particular of readers. No scientist should be so confined within his own special field that he cannot keep himself informed about the progress of science in general and the ferment of ideas in the community of which he is a part. To see the forest, as well as to dissect or carve the tree immediately in front of one, is an essential part of the indefinable spirit that distinguishes the scientific man from other varieties of our species. Here, then, are a few notes that may be helpful in selecting something to read during off-duty hours.

Let's begin with a bit of relatively light reading. Bertrand Russell delivered three lectures at Columbia University last November, under the sponsorship of the Franklin J. Machette Foundation, an organization established "to interest the public in philosophy." The lectures certainly merit the wider audience resulting from their publication as a book.[1] All of Lord Russell's fine sense of humor, incisiveness of diction, and keenness of insight are preserved, so that as one reads the printed page it is easy to see him in imagination as he stood before his audience.

Speaking first of "Science and Tradition" and then of the "Effects of Scientific Technique," Lord Russell contrasts the ancient and the modern views of the nature of the world and of man, and surveys the results of technological developments in recent years. The third lecture deals with "Science and Values," but Lord Russell was thinking about that well-known problem in essentially practical terms rather than from the point of view of an aloof philosopher. Some of you who are grappling with that problem on a deep level will think that his treatment is somewhat superficial. He was, however, addressing a "general audience" and had a very practical purpose in mind.

In summary, his thesis is that far greater well-being than has yet been known may be obtained in the immediate future if men can accomplish the abolition of war, the even distribution of power, and the limitation of population. To achieve those obviously desirable objectives, he recommends not an increase in knowledge alone but also a strengthening of the spirit of love and compassion. He even calls it "Christian love"!

While convalescing from a major operation last summer and fall, President Conant improved the opportunity to produce some very powerful ammunition for his well-known campaign to increase general understanding of the "tactics and strategy of science." He calls his latest book[2] "A citizen's guide to the methods of experimental science." The orientation is quite different from that of his earlier book, *On Understanding Science,* for this one is directed toward all who are involved in the practical problems of the mid-century years, rather than primarily toward those concerned with the education of youth for life in a free society. Appropriately enough, however, considerable portions of the earlier book are woven into the fabric of the new one.

There is space here for only a few of the many highlights of this thoughtful and exceedingly interesting volume. Writers of popular science are advised to indicate more definitely "the distinction between speculative ideas, broad working hypotheses, and well-tested conceptual schemes (though there is, of course, always a hazy boundary between the three types of ideas)." The history of each of the natural sciences includes many examples of the recurring phenomenon, "that the time must be ripe for new ideas to become fruitful or new experience to be appreciated." Speculations leading to ideas that are fruitful of experiments in the laboratory or new observations in the field are useful; "otherwise the free play of imagination can do little more than provide entertainment." Quite commonly it is possible to draw clearly the "contrast between vague speculative ideas and fruitful conceptual schemes."

The necessity for careful distinction between speculative ideas and firmly supported concepts imposes a responsibility upon all authors of scientific literature, but it also should keep all readers alert. Unless we are vigilant we are likely to be led astray by such a book[3] as the one that happens to come next to hand. Fred Hoyle is a brilliant young Cambridge University astronomer who displays a commendable flair for presenting intricate data and mind-stretching ideas in lucid, attractive style. *The Nature of the Universe* is sure to draft a host of readers and be the spark plug for many an earnest conversation. It is in fact a stimulating and informative book, but it should be read with great caution.

Mr. Hoyle presents quite accurately an abundance of information about the recent advances in knowledge concerning the composition of interstellar gas and "dust" that constitute a large fraction of the total mass in the Milky Way galaxy, the presence of "background material" in the vast spaces within the

[1] Bertrand Russell. *The Impact of Science on Society.* New York: Columbia Univ. Press (1951).

[2] James B. Conant. *Science and Common Sense.* New Haven, Conn.: Yale Univ. Press (1951).

[3] Fred Hoyle. *The Nature of the Universe.* New York: Harper (1950).

universe between the galaxies, and the numerous other significant aspects of the universe that are now undergoing observation and study by astronomers throughout the world. His report concerning recent application of principles of electrodynamics to astrophysical problems is wholly trustworthy. His majestic picture of the universe according to "the New Cosmology" is vivid and impressive. His presentation of the concept of "continuous creation," contrasted with the "big bang idea," is scholarly and convincing. But he overreaches when he comes to hypotheses of stellar and planetary evolution and to speculations concerning matters that are at present beyond the pale of "fruitful" contemplation.

For example, he writes dogmatically that "there was once another star moving around the Sun that disintegrated with extreme violence." There is no hint that this is a speculative idea, as yet hardly qualified even to be rated as a working hypothesis because no means are at hand for applying rigid tests of its validity. Or, again, he states that he has "described the way in which planetary systems like our own come into being." He should have said "*a* way in which planetary systems like our own *may perhaps* have come into being." Similarly he "estimates" that there are at least 100,000 planets within the Milky Way suitable as the abode of life, but only the alert reader will be aware that concealed behind the apparently conservative mathematics there is a precarious inverted pyramid of speculation piled on speculation after speculation, interlarded with slippery assumptions.

In contrast, W. C. Allee discusses in his latest book[4] a wholly different, but equally "controversial" subject, with due deference to the advice that I quoted from President Conant's book. Dr. Allee has retired from the University of Chicago as professor emeritus and is now the head professor of biology at the University of Florida. The book in hand is a revised and amplified edition of *The Social Life of Animals,* published in 1938, and like its predecessor it stresses the human implications of the basic principles of biological relationships observed in many groups of animals. It comes at a crucial moment in human history and deserves a sufficiently wide reading to make its cogent reasoning influential in the political debates, great and small, that now demand the attention of every citizen.

Among other things, the book surveys the types of modern evidence concerning the existence of cooperation as an important factor in evolution.

> In so far as any international organization, formal or informal, is based primarily on a hierarchy of power, as are the peck orders of the chicken pens, the peace that follows its apparent acceptance will be relatively short and troubled. . . . The continuing success of the United States as an integrated unit is closely related to the lack of emphasis upon possible peck orders among the states. . . . Widely dispersed knowledge concerning the important role of basic cooperative processes among living beings may lead to the acceptance of cooperation as a guiding principle both in social theory and as a basis for human behavior. Such a development when it occurs will alter the course of human history.

The importance of cooperation in an increasingly significant area of human behavior is implicit in the next book[5] on my list. Emphasizing the hopeful side of the story of atomic energy, Dr. Sacks, of the Brookhaven National Laboratory, devotes a large part of it to the uses of radioisotopes in medical research and therapy. Many significant advances have already been made, and much interesting material, heretofore available only to specialists, is presented for the general reader. Most of such readers will be amazed by the wide variety of ways in which isotopes are now being used—in chemistry, biology, medicine, agriculture, and industry.

Another book that hews closely to the line of scientific accuracy and properly restrained speculation, in spite of its highly imaginative title, is *The Flight of Thunderbolts.*[6] Its author is a member of the Bernard Price Institute for Geophysical Research, University of the Witwatersrand, Johannesberg. Printed in Great Britain, it has been made readily available in this country through the New York office of the Oxford University Press. As all who know their Gilbert and Sullivan will immediately infer, it deals with lightning and atmospheric electricity. The subject provides a case history of general interest, in its progress from myth to knowledge, and it is presented here as an excellent illustration of the scientific method in action. It includes also a wide gamut of problems that are of great practical importance in radio communication as well as of significance in electrodynamics and meteorology. The interest of those who have a particular concern with lightning protection is obvious.

Mr. Schonland approaches the subject from the historical angle and begins with a survey of folklore before recounting the invention of the lightning rod by Benjamin Franklin. He then proceeds with descriptions of the various forms and effects of lightning. This prepares the way for a scholarly consideration of the luminous processes involved in the lightning flash and the electrical processes in the lightning discharge. From an unusually able and interesting discussion of protection against lightning, he goes on to the more theoretical aspects of the electrification of thunderclouds and the indirect and distant effects of thunderstorms. All in all, the book is an outstanding example of good scientific literature, presenting in clear and supple style a subject fraught with widespread interest and involving concepts that have only recently been developed by contemporary researchers.

Finally, there are two excellent books[7] for those of philosophical bent and an interest in the history of ideas: Dr. Reichenbach's book is intended for readers who have "common sense enough to wish to learn more

[4] W. C. Allee. *Cooperation Among Animals.* New York: Schuman (1951).

[5] J. Sacks. *The Atom at Work.* New York: Ronald (1951).

[6] B. F. J. Schonland. *The Flight of Thunderbolts.* New York: Oxford Univ. Press (1950).

[7] Hans Reichenbach. *The Rise of Scientific Philosophy.* Berkeley: Univ. of Calif. Press (1951); W. P. D. Wightman. *The Growth of Scientific Ideas.* New Haven, Conn.: Yale Univ. Press (1951).

than common sense can teach" them. Its thesis is the concept "that philosophy has proceeded from speculation to science." It first examines "the shortcomings of traditional philosophy" and then turns to an exposition of "modern scientific philosophy," collecting "the philosophic results that have been developed through the analysis of modern science and the use of symbolic logic."

The author is professor of philosophy in the University of California at Los Angeles, well known for his previous books and other writing. Here he sums up the results of his earlier studies in a comprehensive and very readable treatise, containing within its pages all the necessary scientific information to give a modern world view.

Dr. Wightman has recently become the first holder of a new lectureship in the history and philosophy of science at the University of Aberdeen. His book was published in Great Britain last year, and the American edition is being released the middle of May. In it, he follows the stream of scientific thought from Thales to the philosophers of the twentieth century, relating each step of discovery to past and future. Science is revealed as "a struggle no less charged with humanistic value than the struggle for political liberty or national expression." Although the intimate relations between scientific theories and technological demands receive appropriate attention, Dr. Wightman does not regard "the socioeconomic as the sole directive in the cultural advance."

Books, Civilization, and Science

Warren Guthrie

Department of Speech, Western Reserve University, Cleveland, Ohio

IT IS WITH A GREAT DEAL OF UNCERTAINTY AND HESITATION that one whose field is rhetoric and public speaking—that knack little better than cookery in Plato's eyes—even ventures near the habitat of men of science. To us science *is* a sacred cow; the scientist, in turn, commonly accepts our discipline as a part of college and university training, with some tolerance but with little enthusiasm.

Why, then, do I write of "Books, Civilization, and Science"? Because a few months ago it was my good fortune to moderate a discussion on this so sharply limited subject at the annual meeting of the American Association for the Advancement of Science in Cleveland. Participating in the discussion were Kirtley Mather of Harvard, Ralph Gerard of the University of Chicago, James Stokley of the General Electric Company, and David Dietz of the Scripps-Howard newspapers. Representing publishers of scientific literature were Hugh Kelly of McGraw-Hill, Charles Skelley of the Macmillan Company, Herbert S. Bailey, Jr., of the Princeton University Press, and, in the absence of Edward Crane of D. Van Nostrand Company, Dennis Flanagan of *Scientific American*. May I hasten to relieve them, individually and as a group, of all responsibility for any statement made in this report. The following lines are my effort, as moderator of the discussion, to summarize the content of that extremely interesting two hours. For such of value as it may contain, credit their contributions to the discussion itself; where it may seem in error or ill-considered, blame the inaccuracies of this reporter.

That there is great need for the writing and publication of scientific books directed to the general reader was apparent to everyone. With the achievements of science an ever-increasing force in our civilization, the need for wide dissemination of scientific learning and method hardly requires proof. Not only is there imperative need for the encouragement of scientific habits of mind; there is an almost equal necessity for acquainting the public with new discoveries and concepts resulting from current scientific research.

Further, the times seem to offer unusual opportunity for meeting this need. The reading public is interested in scientific matters. Its interest has made some scientific—and more pseudo-scientific—books best sellers. Scientists themselves are more aware of the need for interpretation of their field than in many decades. Forced into public life by the tremendous social impact of the discoveries they have made, they seek to help in the constructive, rather than destructive, use of their knowledge. And, finally, there is now an abundance of the kind of material in which the lay public will take interest. New and revolutionary ideas and concepts are literally streaming from our research laboratories. The novel is inherently interesting; the revolutionary demands attention.

With these factors immediately apparent in our discussion it might have seemed in danger of bogging down from lack of a problem, but such was far from the case. For the publishers frequently print, it was charged, and the public likes, the sales records show, the *wrong* kinds of scientific books. The best sellers dealing with matters scientific are those such as *Worlds in Collision* or *Dianetics*. More sound, more responsible, though less sensational works, even when written with an eye to the general public as audience, are seldom as widely read. It was with this problem that our group became largely concerned.

For the charge that they were at fault, the publishers had an immediate and effective answer. Most of the books against which the scientists were most