with secrecy (to protect priority) and the many requests from foreigners that English works be translated into Latin show the difficulties he faced. Through him one can follow, perhaps more clearly than in any other single source, the slow realization throughout Europe—in this generation before the *Principia*—that a new era in man's investigation of nature had arrived. One can sense the wonder and the exhilaration, and for this reason alone one must wish the Halls strength to complete a task that has begun in such exemplary fashion.

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Inventor of an Industry

Light for the World. Edison and the Power Industry. ROBERT SILVERBERG. Van Nostrand, Princeton, N.J., 1967. vi + 281 pp., illus. $5.95.

The protean talents of Thomas Alva Edison continue to attract the attention of biographers. And with good reason. Edison's life was almost a paradigm of the American success story, and Edison himself became something of a folk hero. Few individuals can be accounted responsible for the growth of a major industry in the way that Edison can. He is a particularly attractive figure for the historian of technology because he dealt with a science and a technology readily comprehensible today by even the modestly educated layman. Nor was his life without drama: the struggles with the technology of electricity and his battles with financiers and promoters for the control of his inventions and of the industry they founded are all subjects ready-made for the pen of the narrative historian. If the scientific failures of Edison's later years did not lend a tragic note to his life, they at least provided an element of pathos.

Silverberg, a professional writer with particular experience with children's books, has provided a solid narrative account of Edison's career through the 1890's. His style is lively and consistently interesting, and he guides us with a sure hand through the labyrinthine corporate politics of the early years of the electrical industry. Four pages of illustrations, a satisfactory index, and a brief list or sources (though no footnotes) contribute to the attractiveness of Silverberg's account. All in all it is a craftsmanlike job which will be of considerable interest to that mythic figure the "average reader."

It is not, however, a particularly original or analytical book. Silverberg rightly argues that Edison's major contribution to the industry was not the invention of the incandescent electric lamp but the development of a complete system of power production and distribution as well as illumination. But students of the early electrical industry pointed this out long ago. There is a paucity of clear, precise technological explanation. Indeed, the author is generally content with unanalytical narrative. When he does seek to explain large events he is sometimes on uncertain ground. Suggestions that Edison's innovative barrenness after 1884 was the result of the shattering effects of his first wife's death (pp. 200–01), for example, are largely unprovable speculations.

This volume can be recommended as a sound, interesting narrative account of Edison's role in the development of the electrical industry. But serious students of the history of that industry must still turn to Harold Passer's *The Electrical Manufacturers* (1953), and individuals interested in a comprehensive, authoritative biography should read Matthew Josephson's *Edison* (1959).

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Goals and Purposes

Science Is Not Enough. VANNEVAR BUSH. Morrow, New York, 1967. 192 pp. $4.50.

The title of this book does not prepare the reader for the wealth and variety of its content. It is not an expression of disillusionment from one who has drunk the wine of scientific adventure to the dregs and found them bitter. It is, rather, an anthology of the mature reflections of a connoisseur who knows at first hand the products of many vineyards, who wishes to share his experiences with his friends, and whose imagination envisions even nobler vintages that may be in store for the generations to come.

Like the career of its illustrious author, the volume before us has a scope, a breadth, and a depth that are nothing short of prodigious. In a series of ten essays, Bush discourses on a wide range of human interests in a forthright style that makes the reader oblivious to the passage of time as page after page unfolds a panorama of modern thought and action. Every page sparkles with some flash of humor, some gem of wisdom, some penetrating barb at human foibles, softened by a kindly phrase that reveals the author's sympathetic understanding of human nature. I shall try to summarize the scope of the book without losing its flavor by mentioning the title of each essay and adding a remark or two about its content.

The opening essay, entitled "The builders," describes in poetic prose the activities of those who build the organized structure of knowledge called science. The second essay, "Science pauses," covers the whole field of science from molecular biology to cosmology, even entering the realms of logic and philosophy. Important conclusions may best be described in the author's own words:

> Science, too, has come a long way, in delineating the probable nature of the universe that surrounds us, of the physical world in which we live, of our own structure, our physical and chemical nature. It even enters into the mechanism by which the brain itself operates. Then it comes to the question of consciousness and free will —and there it stops.
>
> Science proves nothing absolutely. On the most vital questions, it does not even produce evidence.
>
> But is all the labor of science vain to the thinker, the seeker after a sure harbor, amid the mystery, evil, cruelty, majesty, that surrounds us? By no means. Science here does two things. It renders us humble. And it paints a universe in which the mysteries become highlighted, in which constraints on imagination and speculation have been removed. . . .

He calls on the philosopher for help, bidding him revive the mission of philosophy in the days of its glory, to dream and guide the dreams of men, "presenting its mission humbly and in the concepts that science offers."

Although every essay carries some message for youth, the third, entitled "The gentleman of culture," should have special appeal to those in the formative years of their lives. After admitting the possibility of adverse reactions to the nouns in the title, the author goes deeply into the modern connotations of both and their significance in the modern world. Let me give the author's idea of a gentleman of culture, adding that he is under no delusion about the obstacles that exist in this

country to the education and development of such men and women.

> He is a man who aspires to wisdom because of his keen interest and broad knowledge of all that conditions his relations with his fellows, and their relations with one another; who goes beyond this and strives to add to the sum total of human intellectual accomplishments, and to establish thinking on a higher and broader plane. He is a man who is modest and kind to the humble and the unfortunate. Above all, he is a man with a mission to minister to the welfare of the society in which he lives, and who takes a just pride in his guidance and his leadership.

In the fourth essay "The art of management" is treated with practical insight, humor, and Yankee shrewdness. "All my life," says Bush, "I have observed managers in action; in government, in universities, and in industry, and I have puzzled over what made them tick. I am far from the end of the puzzle . . . But can we probe a bit toward the essence of the good, the great, managers' success? The world is so short on good managers that it is certainly worth a try." The try is certainly productive. It delineates the profession, the art, and the techniques of management, with special emphasis on, and examples of, that part which can only be learned by experience—the art of leadership.

Twenty years ago, Bush published an essay called "How we may think," suggesting ways in which the new computer technology might be used to construct a personal machine to aid the creative thinker in his work. Such a machine was called a *Memex*. After an intervening period of spectacular advances in the science and the art, the author, in the fifth essay in this volume, "*Memex* revisited," reviews the history and present status of computers and related technologies in a way that is not only satisfying to the expert but also fascinating to the layman. *Memex*, a mere dream 20 years ago, is now an attainable dream, but not yet a reality.

The sixth essay is entitled "When bat meets ball." It begins, "What happens, in the great game of baseball, when the bat meets the ball? All sorts of things happen." There follows an enthralling discourse involving physics, human skill, strategy, psychology, and the use of statistics from one who evidently has a deep knowledge and appreciation of the fine points of the national game. However, his enthusiasm does not extend to the statistics on which the performances of players and teams are popularly judged. This leads to a discussion of the imperfections of data and the treachery of superficial analysis in judging performance in other walks of life.

The essay "Poverty and opportunity" is packed with interesting material, wisely chosen, clearly and honestly discussed. Even a catalog of the topics would occupy this whole review; a selection could be misleading. The concluding sentences give the flavor of the author's philosophy as expressed here:

> The greatest joy in life is that of accomplishment. . . . By all means let us abolish poverty, but not forget that man does not live by bread alone, and that the spirit of man is best ministered to by giving to him opportunity that is real and unfettered.

The principal theme of "Democracy and the medical profession" is the social responsibility of the professions, with examples drawn from medicine. After emphasizing that "the prime necessity of successful democracy is not merely reliance on the voice of the people, but the protection of minorities," the author reflects on the obligation of the professions as minorities to see that they contribute fully to refining and making work the system of which they are a part. No profession faces greater or more immediate challenges than the ancient one of medicine, with respect to which the author gives a very timely description of problems that are among the toughest ever faced by a democratic system.

"It is earlier than we think," the ninth essay, opens with a very big question: "Why are we here and what is our object and our duty as we pursue our daily lives?" It maintains this high standard to the end. The author discusses at some length the ways in which different people respond to this question. Here again he draws on his extensive knowledge of science and of human motivation, concluding that all responses converge on one short-range objective, namely to make our world a better one for people to live in. While conceding that this is a worthy and indeed a necessary objective, Bush sees it as only ancillary to an even greater one, namely to prepare the way for the evolution of new systems of thought and action that surpass in power those now known to us by as much as the present methods of science surpass those of the medieval schoolmen. The concept that man is yet young, that the full power of his thought has not yet been developed, gives the title to this essay and, indeed, to the whole book.

In a world of stress and peril, with the shadow of sudden destruction ever present, does it make sense to pursue knowledge for the sake of understanding and not necessarily for the power it brings? Bush's answer in his final essay, "The search for understanding," is an emphatic yes. The search for understanding is a privilege granted to men. It brings an obligation they ignore only at their peril.

This book is, however, much more than a collection of entertaining essays. It is a synthesis of the experience, an expression of the faith of one who has observed keenly, labored fruitfully, fought fearlessly, and pondered deeply on the meaning of it all. The essays provide media for the elaboration in various contexts of a core of central thoughts, the sincere beliefs of the author. It is truly a humanistic document. But it transcends mere humanism. The author has caught a glimpse of a power beyond the present grasp of the human mind, a power that has given men the instinctive desire to understand, and the capacity to fulfill this desire. We have not yet explored this capacity to its fullest extent.

I commend this book most highly to the thoughtful scientist and layman alike; I know that both will find in it a rare intellectual treat, much to learn and a great deal to enjoy. To the pedant, the bigot and the dealer in soft intellectual currency, I must give a warning; its outlook may be too catholic and its flavor too salty for your taste.

I would also recommend this volume enthusiastically to young men and women who, at the outset of their careers, are seeking goals worthy of the investment of a lifetime. It will answer many of their questions, cutting through the noise and confusion of the 1960's, bringing them inspiration, perspective, and challenge. The inspiration comes from the example and achievements of great men in the past, and a vision of exciting opportunities for those prepared to meet the future. The perspective is that of a man who has distilled wisdom and kindliness from wide experience in the arena of life. The challenge invites them to forego the easy pleasures of this world for the more satisfying ones that come to those who choose the hard path to excellence so that they may serve their fellows as wise, responsible leaders in a democracy of free men.

A most remarkable book!

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