

The opposite of knowledge

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The Privilege of Being a Physicist. By Victor F. Weisskopf. W.H. Freeman: 1989. Pp.235. \$17.95, £12.95.

It is appropriate that the most prominent word in the title of Victor Weisskopf's book is *Privilege*. Through talent and hard work, Weisskopf has gained an international reputation and has attracted many honours; yet he is that rare kind of man who regards it all as a privilege.

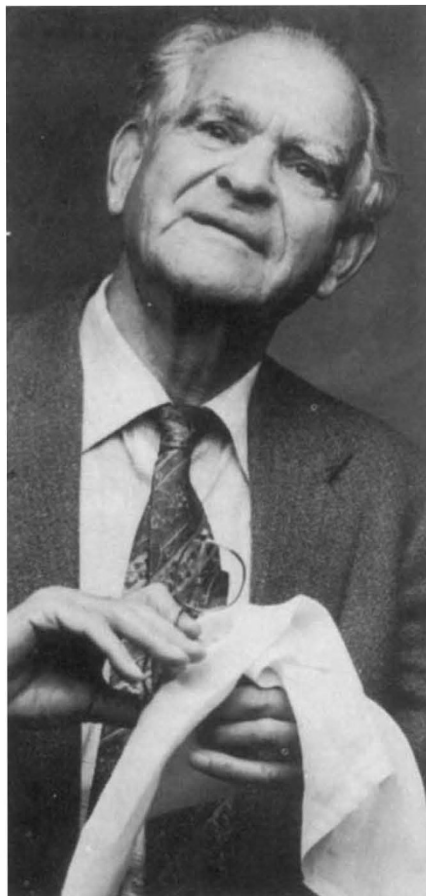
For readers familiar with two of Weisskopf's earlier books, *Knowledge and Wonder* (Doubleday, 1962) and *Physics in the Twentieth Century* (MIT Press, 1972), the appearance of this new work will be a happy event. It brings together 16 essays: two were written specifically for the book, the others have mostly appeared over the past ten years (although four of them have been expanded for the present collection). The subjects covered are some of the principal ideas of twentieth-century physics, two of the physicists who participated in the creation of those ideas, and the relationship of science to culture and to society.

The theory of quantum mechanics was created during the years 1925–1927. For those who followed events, it was a time of intellectual exhilaration and purgation. Conundrums that had plagued physicists during the early years of the twentieth century were suddenly resolved — provided they were willing to accept nature on entirely new terms and think in entirely new ways. To engage one's mind in thinking about such a conceptually rich subject, and to do so in the fundamental ways that were required to create the formalism of quantum mechanics, is an experience that alerts the mind to the broad place of physics in human activities.

With just a touch of sadness, Weisskopf has acknowledged that he came to physics "three years too late" — too late, that is, to be an active participant in the creation of quantum mechanics (*Physics in the Twentieth Century*, p.4). Starting in 1929, however, he made many seminal contributions through the application of quantum mechanics to our understanding of matter. Moreover, he has been one of those theoretical physicists who has thought deeply about the ideas of quantum mechanics and about the interpretation of this incredible theory. In addition, he knew personally men such as Bohr, Heisenberg and Pauli who were the architects of quantum mechanics and he bears their influences. This is the background that Weisskopf brings to his writing.

Although they were written for the

general reader, scientists will also find the essays edifying. Weisskopf does not present physics as an activity isolated from values and emotions. Quite the contrary. He shows us how physics and the humanities arise from the same universal values and complement each other. Teachers at all levels would be well advised to read and ponder the contents of the book. Too often science instruction takes the form of transmitting bits of knowledge that are isolated from any scientific, cultural or human context. But such bits of knowledge provide students with no under-



Weisskopf — a rare kind of man.

standing of science. Weisskopf goes further: in the chapter "Teaching Science", he asserts that "science is the opposite of knowledge" and portrays science as the product of curiosity and questioning which can lead to a "fuller, more meaningful life".

Weisskopf is at his best when he writes about the ideas of physics. In "What is Quantum Mechanics?", written specifically for this collection, we learn how "the primal shapes of nature" bring stability to atoms and how the uncertainty inherent in nature really brings the certainty that renders all atoms of a given element identical. This essay, along with "What is an Elementary Particle?", "Contemporary Frontiers in Physics" and "The Origin of the Universe", reveals not only the depth of Weisskopf's understanding, but also demonstrates his expository skill. For

their clarity and insight, these essays are outstanding.

Wolfgang Pauli and Werner Heisenberg are each the subject of Weisskopf's attention. Pauli is typically the subject of many anecdotes; Weisskopf adds to them and, in the process, brings insights to Pauli's intriguing personality. In the case of Heisenberg, Weisskopf's admiration of the man prompts an explanation of his wartime activities; this account is based largely on *Inner Exile* (Birkhäuser, 1984), the recent book by Heisenberg's widow, and in comparative terms it is somewhat more generous than the findings of contemporary historians such as Alan D. Beyerchen (*Scientists Under Hitler*; Yale University Press, 1977).

Implicitly, Weisskopf extends the same generosity to American physicists. If quantum physics can be said to have had a determining influence in Weisskopf's life, so can his experiences at Los Alamos. In 1943, Hans Bethe persuaded Weisskopf to join the team at Los Alamos and work on the development of the atomic bomb. Weisskopf became one of the prime movers in the Manhattan Project. When the war ended, however, he refused to participate in the further development of nuclear weapons; rather, he helped to form the Federation of Atomic Scientists, a group whose purpose was to alert the public to the dangers of nuclear war. In making this decision, Weisskopf differed with many of his fellow physicists who on the one hand called for an end to the arms race and on the other continued to develop successive generations of nuclear weapons. As the history of the post-war period is now being written, it is apparent that one of the primary driving forces of the arms race has been the ability and willingness of physicists to realize technical possibilities which have inevitably proved irresistible to political and military leaders. In this regard, Weisskopf might have expanded his concept of the privilege of being a physicist to include more directly and more insistently the idea of responsibility. As for himself, Weisskopf's responsibility has been fulfilled: in the book he continues to call for an end to the madness of nuclear weapons.

The essays were written over a period of years, so there is some repetition; I suggest that each of them should be read individually (rather than consecutively). In this fashion, they will reinforce each other while each is savoured. □

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• Part 2 of Solly Zuckerman's memoirs, *Monkeys, Men, and Missiles: An Autobiography 1946–1988*, has been published in the United States by W. W. Norton. Price is \$22.50. The British edition was reviewed by William Cooper in *Nature* 336, 285 (1988).