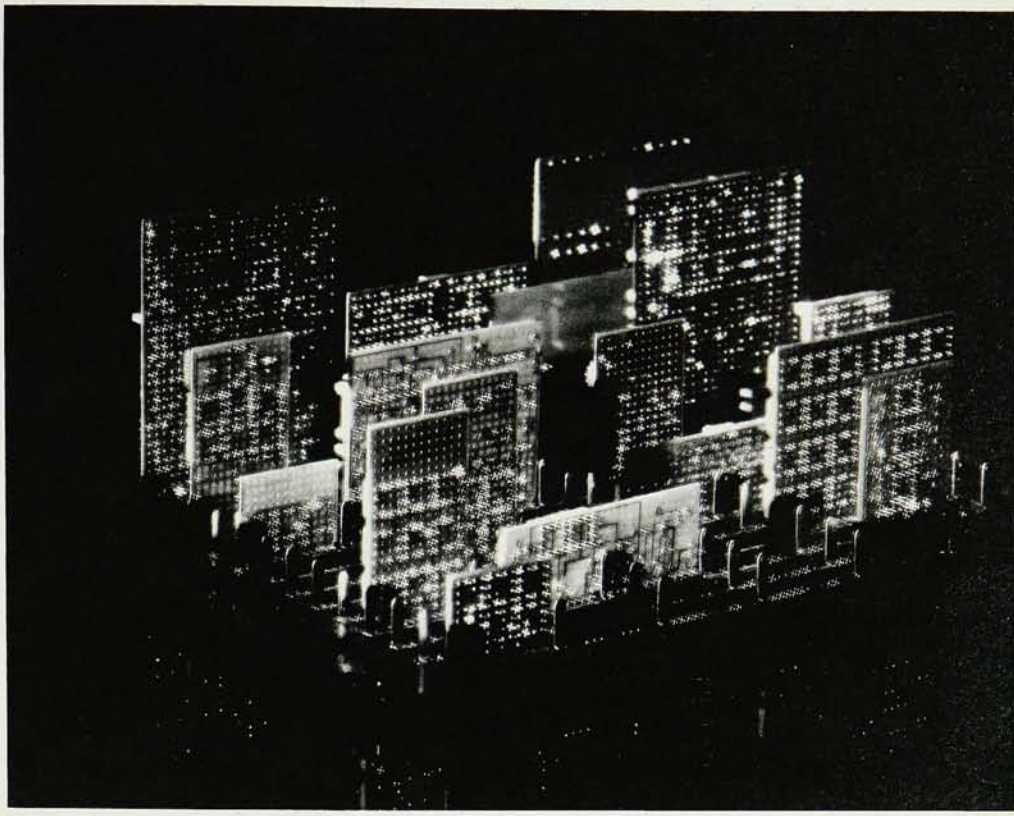
On science and society

REFLECTIONS ON BIG SCIENCE. By Alvin M. Weinberg. 182 pp. MIT Press, Cambridge, Mass., 1967. $5.95

by Raymond Bowers



THE COMPUTER REVOLUTION prompts Alvin M. Weinberg, in the book under review, to ". . . pray that the humanists will supply those deeper values that up to now Western man has had no time to cherish, but which in the future he will have too much time to survive without." Raymond Bowers doesn't think that they will.

This book is a collection of essays by Alvin Weinberg on a wide range of topics concerning the impact of science on society. Weinberg is director of the Oak Ridge National Laboratory, and the essays are based on talks and articles he previously published. I can recommend the book without hesitation. Of all the writers in the rapidly growing field of science policy, Weinberg is surely among the most provocative, the most articulate and the most thoughtful. There is lots to agree with and lots to disagree with in all the essays, but I found them all interesting. The volume represents a significant contribution to a debate that is daily becoming more important.

In the first article called "The Promise of Scientific Technology: The New Revolutions," Weinberg concentrates on two modern technological revolutions, the development of nuclear energy and the revolution being brought about by the development of the computer. In the area of nuclear energy Weinberg is a responsible but unashamed enthusiast, as is appropriate for the director of Oak Ridge. He sees the generation of power from nuclear fission and perhaps from nuclear fusion as the only answer in the next century to the almost insatiable demand for energy. Similarly he sees the computer in an optimistic framework, as technology's answer to our modern society's demand for more and more data and more and more information. It is little reflection on this article to say that this reviewer does not share all aspects of Weinberg's optimism in these areas. Weinberg is enthusiastic about the contribution that the new technology can make towards peace by bringing cheap power to the underdeveloped countries and in this way reducing the disparity between the rich nations and the poor nations of this world. I would like to be optimistic about this also, but surely one can argue that increasing technology has benefited the rich industrial countries far more than the underdeveloped countries, and at this time the greater danger is that it will further increase the gap between these two. Weinberg would also like to believe that large-scale desalting will reduce tensions in the Middle East when water no longer becomes an important matter to fight about; that is what I call an optimist!

In the first essay he only touches lightly on one of the really profound problems of large-scale development of automation and computers, namely the question of how modern man is going to use the increased free time that these tools will make available to him. He recognizes that such a topic leads one into the discussion of the meaning and purpose of life and work. In this connection he turns to the role of the humanist in filling the void that is clearly developing. He says, "We scientists. . . .can pray that the humanists will supply those deeper values that up to now Western man has had no time to cherish, but which in the future he will have too much time to survive without." I cannot speak for Weinberg, but for myself I am not counting on them.

In part 3 of the book, Weinberg bravely wanders into the treacherous area of "Criteria for Scientific Choice." In developing his criteria, he places very heavy emphasis on the relevance of a field to neighboring areas of science. He insists that "that field has the most scientific merit which contributes most heavily to and illuminates most brightly its neighboring scientific disciplines." It is implicit in his view that the impact of one field on another can be foreseen with some confidence. I am less confident than Weinberg; I do not think I could have foreseen the consequences of Faraday's work, let alone all that crazy stuff about $E = MC^2$. (I am being slightly unfair, but only slightly, because Weinberg is primarily concerned with Big Science.) Weinberg applies his principle to some contemporary fields; it causes him to smile on molecular biology and to frown on high-energy physics. Nuclear energy gets an A+, space exploration a *D*. He would like to give the behavioral sciences much greater support, but he is worried about whether they are ready for it.

There is lots more in this excellent book. There are essays on scientific communication, national laboratories, universities and disciplines, biomedical science, scientific choice and human values as well as other topics. They are generally stimulating and even delightful when the ox being gored belongs to a neighbor. I will not be surprised if the book is widely used in the various seminars and courses that are developing in the area of Science and Society. Somebody should try his hand at writing a rebuttal as soon as possible.

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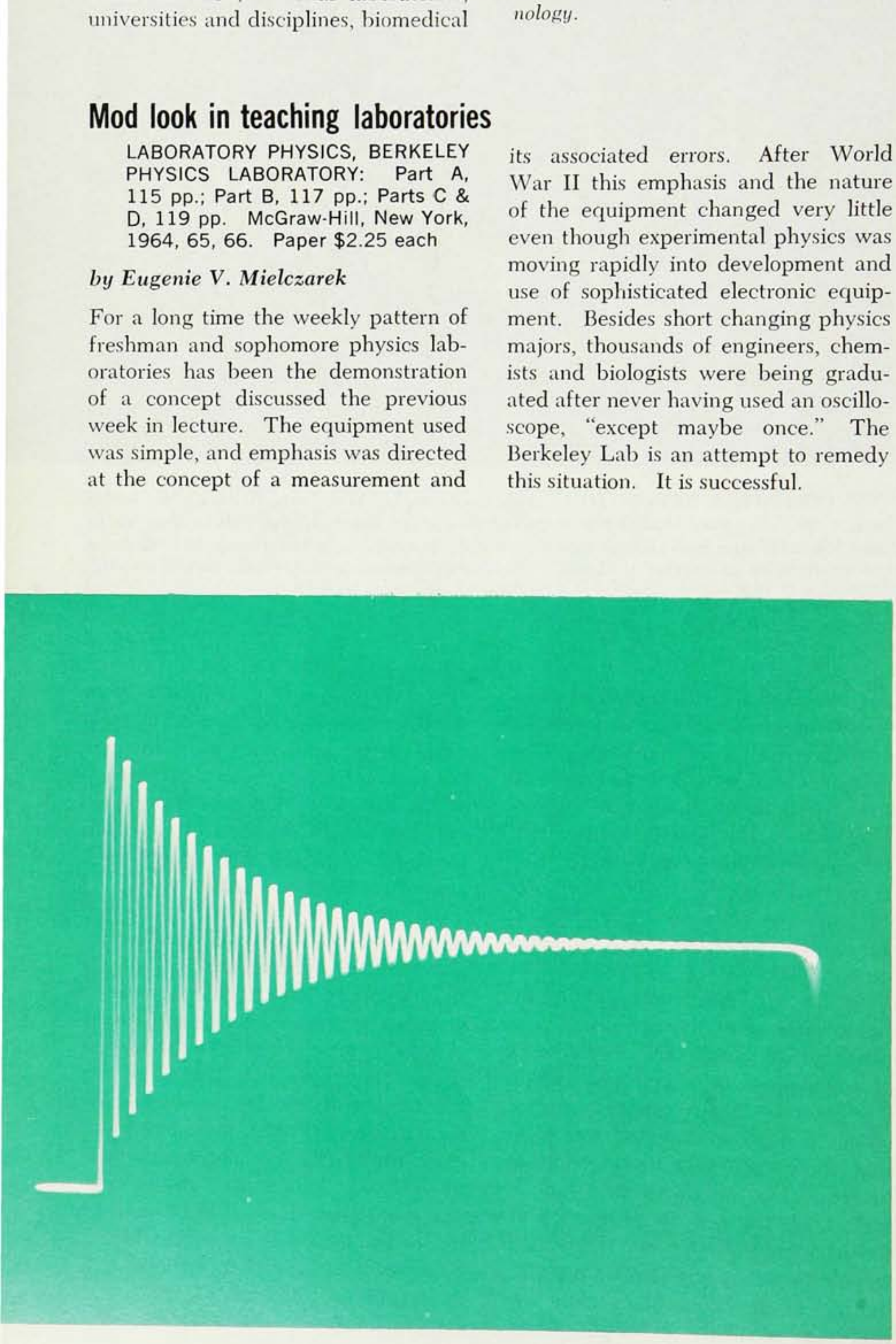
Mod look in teaching laboratories

LABORATORY PHYSICS, BERKELEY PHYSICS LABORATORY: Part A, 115 pp.; Part B, 117 pp.; Parts C & D, 119 pp. McGraw-Hill, New York, 1964, 65, 66. Paper $2.25 each

by Eugenie V. Mielczarek

For a long time the weekly pattern of freshman and sophomore physics laboratories has been the demonstration of a concept discussed the previous week in lecture. The equipment used was simple, and emphasis was directed at the concept of a measurement and its associated errors. After World War II this emphasis and the nature of the equipment changed very little even though experimental physics was moving rapidly into development and use of sophisticated electronic equipment. Besides short changing physics majors, thousands of engineers, chemists and biologists were being graduated after never having used an oscilloscope, "except maybe once." The Berkeley Lab is an attempt to remedy this situation. It is successful.



The author of the laboratory, Alan Portis, and his associates have created a coherent set of experiments through the investigation of a series of topics germane to modern research problems. In these experiments they have chosen to emphasize electrical skills common to most scientific research. Typical topics covered are electron dynamics, coupled oscillators, electromagnetic wave phenomena and statistical phenomena. Thus the Berkeley Physics Laboratory is a definite break with the traditional freshman and sophomore physics laboratories.

The laboratory is divided into three parts, A, B, C and D. It is published in three volumes, C and D sharing the same volume. Part A is an introduction to the mechanics of free and nearly free electrons. In all of the experiments either a cathode-ray tube or an oscilloscope is used. Typical experiments are time of flight of electrons, damped oscillators and nonlinearity. Four of the experiments involve semiconducting circuit elements. Oscilloscope functions that the student learns are presentation of Lissajous figures, beam-intensity modulation and sweep synchronization. Part B continues the introduction to semiconducting devices and simple associated circuits, with a natural progression from oscillation to coupled oscillators to propogation of electromagnetic waves using simple microwave plumbing. Parts C and D provide an introduction to some of the experimental problems and techniques of atomic and nuclear physics. An introduction to statistical physics includes Geiger counting, thermionic vacuum diodes, photoemission, and finally a set of experiments on photon polarization and interference. Part D is a collection of 14 reprints of some of the classical experiments in modern physics: electron diffraction, atomic spectroscopy, the Franck–Hertz experiment, magnetic resonance and optical pumping.

One of the best features of the laboratory is the cost. Presently it is marketed by two firms, Hickok Teaching Systems, Inc., and Heath Company. The cost of all three semesters excluding Part D is about $38.00 per station per experiment. The second feature is the challenge it presents to the student. The material is an extension of lecture material, and in each experiment the theoretical material is presented very completely and clearly. Minimal directions are given, and it is virtually impossible for the student to