EDITORIAL

Physics Today—Yesterday and Tomorrow

Henry Barton and Elmer Hutchisson in their articles in this issue have discussed the development of PHYSICS TODAY over the last 20 years. Others have considered the progress in specific fields of physics. I should like to comment on more general aspects of the development of physics in this period and the outlook for the near future.

The post-World War I period is often referred to as the age of the chemists, whose research was brought into prominence by war developments. In much the same way physics and the work of physicists came into the spotlight in World War II. The atomic bomb, radar and, a little later, satellites and nuclear power, to mention a few items, gave physics and its applications a glamor. The resulting rapid growth of the discipline quickly showed itself in many ways. The unduplicated membership of the societies affiliated with the American Institute of Physics increased from 10 000 in 1948 to 46 000 in 1967; the number of pages in the AIP journals and bulletins grew in the same period from 12 226 to 59 160 plus 22 300 in translated journals; the annual production of PhD's in physics went from 200 to 1100, and underlying and supporting this growth the financial support of physics research by the federal government increased through the period by about 16% a year. These figures are all doubling in the neighborhood of once every seven years. They are, of course, related. In fact if we accept the estimate that a page of archival-journal research publication represents about $20 000 of support, each additional million of federal support can be expected to produce 50 more pages of research publication. If 75 million dollars per year of new money is going into basic research in physics, we can account for the growth rate in AIP publications of 5000 pages a year. The productivity of physicists of about one page per physicist per year has not increased much over the last 50 years. There are more physicists.

The "Pake" report, *Physics Survey and Outlook*, suggested that an increase of at least 15% a year in federal physics support was required to maintain the present desirable growth rate. However, the growth of federal support has slowed in the past four years and Donald Hornig, the President's science adviser, estimates a 7% increase in federal research funds in the 1969 budget over that in fiscal 1968. This increase is little more than adequate to cover the annual increase in the cost of living. The 15% per year rate of increase, which held true for a few years preceding 1963, arose from a National Academy of Sciences summer study in 1958, done at the request of the US Air Force. This group arrived at the requirement of 15% to maintain the momentum of basic science as representing the need of 5% to cover inflation, 5% to cover the increase in sophistication in research equipment and technology and 5% to provide support for new scientists entering the field. It was, of course, clear even then that a 15% growth could not long be supported. It would have led to a situation in the year 2000 in which every citizen of the US would have a PhD in science and in which, since the gross national product increases at about 4% a year, the GNP would be overtaken by the scientific expenditures, which would then consume the whole gross national product.

The immediate factor halting growth in scientific support is the increase in cost of the military operations in Vietnam. Perhaps more basic are the growing feeling in Congress that the returns from basic science in terms of improved technology do not justify further rapid increases in support and the trend of students toward fields other than physics so that the number of undergraduate majors is beginning to fall off. The public image of science has been tarnished by fear of atomic bombs and of possibly even more terrible applications of science, by the thalidomide tragedy, by the effects of new pesticides, and by the possibility of genetic control.

At present, urgent problems of urban renewal, pollution control, public transportation and others are competing for federal support. It is certain that social problems will occupy more public attention and demand more public funds in the future.

The AIP has prepared for this new atmosphere by establishing a Committee on Physics and Society. COMPAS, as it is called, is studying the questions of how we can improve the image of physics as an indispensable adjunct to our culture and our technology and of how physics and physicists can contribute to our new social needs.

The committee has not reached its conclusions yet. As an individual, however, I think I can see an era with slower growth of federal support of basic research, with an increasing demand for physicists in industry and federal laboratories and with a call for physicists to devote themselves to studying problems of society such as air and water pollution, oceanography and development of ocean resources, environmental control and space research. Physicists are fitted by their research and theoretical training to contribute to these problems. They met strange problems in World War II, and I am confident these new problems will present a challenge that they will meet with the same enthusiasm and success. Physics has always changed from generation to generation, and its problems have always been new and rewarding.

—Ralph A. Sawyer

Ralph A. Sawyer has been chairman of the Governing Board, American Institute of Physics since 1959. He earned degrees at Dartmouth and Chicago and taught at Chicago and Michigan, where he became graduate-school dean and research vice-president. In 1946 he was technical director of the Bikini bomb-test task force and was president of the Optical Society of America from 1955 to 1957. He is the author of *Experimental Spectroscopy* and has served on numerous scientific and Defense Department committees and boards.