ments with radioactive strontium (*1*) and in cases of radium poisoning in man (*2*), possibly because only a part of the hemopoietic system is exposed to the radiation from bone-seeking materials. Others have estimated the effect of fallout on leukemia, on the assumption that strontium-90 is as effective as the equivalent penetrating radiation, at least with regard to the induction of those kinds of leukemia which are believed to originate in the bone marrow (*7*). However, the estimates others have obtained are very similar to the numbers indicated in Table 1 for osteosarcomas and do not greatly alter the present comparisons. It should be noted also that the estimation of genetic damage neglects all except the serious hereditary defects, although the less serious defects tend to be inherited over a larger number of generations, and thus affect more people before they are eliminated.

Remembering that Table 1 compares an approximate *upper limit* for the strontium-90 induced osteosarcomas with a conservatively chosen estimate for the serious hereditary defects, two conclusions might be drawn from the comparisons.

First, fallout in the future might perhaps result in more osteosarcomas than serious genetic defects, but the reverse could equally well be true, and there is no certainty that there will be any osteosarcomas at the strontium-90 levels considered in Table 1. Thus, in spite of assertions to the contrary (see *2*, p. 80, paragraphs 4a and 4b) there are, as yet, no objective grounds for deciding which will be the greater of the two hazards.

Second, the "permissible" levels for strontium-90 exposure in large populations would seem to have been chosen with greater caution than those for penetrating radiation to the reproductive tissues. The numerical discrepancy in the estimated damage in the two cases as shown in Table 1 is in the range from ten-fold to 100-fold, and the true discrepancy may be much greater still. If we wish to be equally cautious with respect to both kinds of hazard, it would seem (i) that future revisions of the "permissible" levels for populations must be based on an attempt to assess the two kinds of damage in comparable terms and (ii) that there must be a common guiding principle in deciding how large an effect is acceptable in each case.

References and Notes

1. *Biological Effects of Radiation, Summary Reports* (National Academy of Sciences–National Research Council, Washington, D.C., 1956); *Pathological Effects of Atomic Radiation* (National Academy of Sciences–National Research Council, Washington, D.C., 1956).
2. Medical Research Council of Great Britain, *Hazards to Man of Nuclear and Allied Radiations* (H. M. Stationery Office, London, 1956).
3. Personal communication from the National Cancer Institute of Canada, regarding the data of T. A. Watson.
4. M. P. Finkel, *Peaceful Uses of Atomic Energy* (United Nations, New York, 1956), vol. 11, p. 160.
5. A. O. Salinas *et al.* [*Cancer* 9, 528 (1956)], suggest that excessive dosage is an important factor in the induction of bone sarcomas by therapeutic exposures to x-rays.
6. The dose required to double the mutation rate in man is probably within the limits from one-third to 3 times the figure used. The figure for the incidence of severe hereditary defects is conservatively chosen, and the true value may be twice as great. The estimate of the damage neglects entirely mutations having slight effects, but, since these would tend to linger in the population for a much longer period before being eliminated, their collective significance may be greater than that of the mutations for severe defects. It is assumed that heterotic and related effects are not responsible for maintaining in the population more than a small part of the present load of hereditary diseases and that this load represents an equilibrium level. If the first of these assumptions is in error, the estimates will tend to be too large; and if the second is in error, they will tend to be too small.
7. E. B. Lewis, *Science* 125, 965 (1957).
8. For the relationship between strontium-90 burden and rep in bone, see *Pathological Effects of Atomic Radiation* (National Academy of Sciences–National Research Council, Washington, D.C., 1956), pp. II-9 and II-13, Table IIB.
9. For natural radiation to gonads, see *Biological Effects of Atomic Radiation* (National Academy of Sciences–National Research Council, Washington, D.C., 1956), p. 50, Table 2. The dose to the gonads from fallout is taken from *Hazards to Man of Nuclear and Allied Radiations* (*2*); it is assumed that the exposure is largely from short-lived isotopes.
10. The figure for the strontium-90 level in milk samples collected across Canada during 1956 was obtained from W. E. Grummitt and J. E. Carruthers (report in preparation). It has been assumed in Table 1 that the ratio of strontium-90 to calcium in bone will follow that in milk [see W. F. Libby, *Proc. Natl. Acad. Sci. U.S.* 42, 365 (1956)]. If there is discrimination against the passage of strontium-90 from milk to bone, the figures given in Table 1 will be too high. The figure for penetrating radiation to the gonads is that given in the U.S. report (*1*), based on the accumulated exposure over the preceding 5-year period. The probable limits are one-fifth, and 5 times, the figure given. Assuming that the greater part of the penetrating radiation comes from short-lived isotopes present in the early fallout, the exposures during successive 30-year periods would tend to remain constant. It is emphasized that projected future levels for strontium-90 are of necessity speculative at the present time.
11. Medical Research Council of Great Britain, *Hazards to Man of Nuclear and Allied Radiations* (H.M. Stationery Office, London, 1956), paragraphs 281, 283, and 360.
12. For the strontium-90 level at which no concern is expressed, see *Pathological Effects of Atomic Radiation* (National Academy of Sciences–National Research Council, Washington, D.C., 1956), p. II-9.

H. E. Sigerist, Social Historian of Medicine

For more than 2000 years the history of medicine has been studied and interpreted in some form. During this period, the purposes that motivated those who concerned themselves with the past of medicine and the evaluations derived from the materials available to them have varied considerably. Throughout antiquity and indeed far into modern times, such activity was motivated by a doxographic interest—by a desire to learn and to present the opinions and methods of previous medical generations. The essential purpose behind these writings is perhaps closer to that of the modern writer of a medical paper, who cites his immediate predecessors in the particular field of interest, than it is to that of the historian.

Within the present century, a more sophisticated approach to medical historiography has become increasingly prominent and influential. The keynote of this approach is the proposition that medicine is an activity whose development can be most fully understood only when it is considered in relation to the network of social interaction within which it occurs. Taking the social character of medicine as a point of departure, its history becomes the history of human societies and their endeavors to cope with problems of health and disease. While a number of medical historians, both in this country and abroad, have studied the development of medicine in terms of social factors and institutional structures, the foremost proponent of a need for reinterpretation of medical history from this broader viewpoint was Henry Ernest Sigerist, commonly recognized as the leading medical historian of his generation. Consequently, it was an occasion of distress and sorrow for the many who had known him personally or

through his writings to learn that Dr. Sigerist had died, on 17 March 1957, at his home in the village of Pura in Switzerland.

Sigerist came to the United States in 1931 as a visiting lecturer. While in this country he was asked by William H. Welch to succeed him in his chair of medical history at Johns Hopkins University and to become the director of the first American Institute of the History of Medicine. Welch wrote that Sigerist's "coming to Johns Hopkins is one of the most important events in the history of the University for years." The following 16 years brought to full fruition those qualities that won for him so great a number of students, friends, admirers—and adversaries.

Born in Paris on 7 April 1891, the son of a Swiss businessman, Sigerist was brought up in Zurich and, at the age of 20, spent a year (1910–11) at the School of Oriental Studies in London. After receiving his medical degree at Zurich in 1917, he served for 2 years as a physician in the Swiss army. After the end of World War I, in 1919, he turned to postgraduate work in medical history under the great German medical historian Karl Sudhoff, whom he succeeded in 1925 in the chair of medical history at Leipzig, after a short period at Zurich.

Sigerist brought home to his American auditors the meaning and potentialities of scholarship in relation to medical history. But the potentialities that he saw in historical study involved an organic linking of the past not alone with the present but equally with the future. "To me," he wrote, "the best way to understand a complex phenomenon has always been to study its genesis." Furthermore, at Zurich and then at Leipzig, he had been developing his recognition that medicine is but one aspect of the general civilization of a period—"that it is always determined by the general cultural conditions and by an underlying philosophy." As a stage in this process there comes to mind Sigerist's endeavor, in 1928, to define the position of William Harvey in European cultural history by analyzing his work as an instance of Baroque biology. Eventually he expanded this view into a broad sociologic concept in which medicine was seen within a matrix at once political, economic, social, and cultural. For Sigerist this concept was a tool which made it possible to investigate the past not only for its own sake but as a means of contributing to the urgent present problems of medicine and of helping to prepare the future. In his book *Medicine and Human Welfare* (1941), he set forth his position as follows: "The historian of medicine wants to know what has happened in the past and what is happening today. He endeavors to understand the phenomena of health and disease and their significance for the individual and for society."

From such a broad, socially oriented position, it is as logical to study the contemporary development of medicine as to analyze its evolution in the past. And to this endeavor Sigerist bent a considerable part of his energies while he was at Johns Hopkins. His visit to this country in 1931 was followed by a study of medicine in the United States [*Amerika und die Medizin* (1932); *American Medicine* (1934)]. Because of his belief that "the future of medicine will largely depend on what will be done in the United States and the Soviet Union," he then proceeded to study medical developments in the latter country. His account of *Socialized Medicine in the Soviet Union,* which appeared in 1937 and was reissued in a revised edition in 1947, was thus a necessary complement to what he had written about American medicine. In addition, Sigerist studied medical conditions in South Africa in 1939, and after World War II he visited India, Ceylon, the Philippines, and western Canada for the same purpose. Combining theory and practice, Sigerist worked actively for the establishment of an organization of medical care that would be more in consonance with the needs of our time. He was intimately involved with the movement for a national health insurance act in the United States and was also called on for counsel in other countries on problems concerned with the reorganization or improvement of medical care.

During this period, Sigerist also developed a comprehensive theoretical structure for the social history of medicine, which he intended eventually to write. Several books published in the 1940's may be considered interim reports in this process. The Terry lectures, which Sigerist gave in October 1940, at Yale University, appeared the following year under the title *Medicine and Human Welfare*. They were followed in 1943 by the publication of *Civilization and Disease*—the Messenger lectures, given at Cornell University in 1941. In these lectures Sigerist undertook to correlate the development of medicine with the history of human society. The method by which he did this was to seek out and analyze the points at which civilization (or culture) and disease have interacted and affected each other. Among the fields he examined were economics, law, religion, philosophy, science, literature, art, and history. In relation to these he studied disease, health, and the physician. These studies were to culminate in a monumental eight-volume history, of which the first volume appeared in 1951.

At the same time Sigerist did not neglect more specialized investigations or the teaching of medical history. A glance at the papers published while he was in Baltimore reveals the breadth of his interests. Medical geography, medieval medicine, health education, art and medicine, fee bills, hospitals, Boerhaave, Paracelsus, medical education, balneology, medicinal wines, public health and hygiene, medical etymology—these are only a few of the topics to which Sigerist turned his attention. Many of these papers appeared in the *Bulletin of the History of Medicine* which he founded. Fully aware that no scholar can work in a vacuum, he undertook to establish channels of communication for those concerned with medical history. To further this purpose he established several monograph series, as well as the *Bulletin,* and organized a number of conferences. Furthermore, in this connection he reorganized the American Association of the History of Medicine, imbued it with his own dynamic energy, and made the *Bulletin of the History of Medicine* its official publication. Perhaps most important was the fact that his humanistic approach, contagious enthusiasm, clarity of thought, honesty, and broad background of interest captivated physicians, medical students, and laymen alike. Sigerist was a great teacher, and there is no doubt that the increased interest in medical history in America at present is largely attributable to his influence.

After having been at Johns Hopkins for 15 years, Sigerist returned to Switzerland to write his projected *History of Medicine*. When the first volume appeared, in 1951, it was clear that while it dealt with only a few ancient societies, it nevertheless set a new pattern of medical historiography. Sigerist had, in a sense, worked all his life at the creation of this *History of Medicine*. Equipped with a wide knowledge of languages and of biological and social science, and with 25 years of research and teaching behind him, he was able to synthesize these various elements in terms of a clear-cut philosophy of history. It was clear that the social history of medicine had come of age. While his untimely death did not permit the completion of his original plan, it is apparent that he had at least formulated the plans and laid the foundations for a history of medicine which can see problems of health and disease not only from the viewpoint of the medical profession but from that of society as a whole.

Much more might be said about Sigerist, but one fact stands out above all. He has left with us some of his sense of freedom, his understanding of the problems of human welfare, and his faith in the future of mankind.

GEORGE ROSEN
School of Public Health and Administrative Medicine, Columbia University