

1973/1974

Yehuda Elkana, Joshua Lederberg, Robert K. Merton, Arnold Thackray and Harriet Zuckerman—“*Historical Sociology of Scientific Knowledge.*”

As members of a POSTS “core” project, Elkana, Lederberg, Merton, Thackray and Zuckerman spent the greater part of the year focused on aspects of the historical sociology of scientific knowledge and on methods for assessing the condition of science.

It is, of course, difficult to assess the current state of the scientific enterprise. Efforts to do so are still in their early stages. In the early 1970’s, the National Science Board instituted a project designed to attempt to answer such questions as these: What has been accomplished in science as gauged in terms of what could have been accomplished? To what extent is scientific activity being directed? What are the strengths and comparative weaknesses in contemporary American science? Are scientific personnel being trained in the fields where they will be most needed? A first step in answering questions such as these is the development of sets of indices which will indicate the strengths and weaknesses of U.S. science and technology in terms of the capacity and performance of the enterprise for contributing to national objectives (including international peace). The first results of a study in the use of such indices of the condition of science was published by the National Science Board as its Fifth Annual Report, *Science Indicators 1972*.

Under the joint auspices of POSTS and the Social Science Re-

search Council, the members of the POSTS "core" group arranged for a three-day conference held at the Center in mid-June. The conference of scholars at work in the history, politics, economics, philosophy, and sociology of science was attended by several members of the National Science Board and by staff members of the National Science Foundation as well as by several additional Fellows at the Center. The members of the POSTS group in the Historical Sociology of Scientific Knowledge are editing a book which grew out of that conference. The book, based on papers presented at the meeting and supplemented by others generated by the discussion, sets out the problems and prospects for developing measures of cognitive and institutional developments in science. The title of the book is *Toward a Metric of Science* and its publication is expected next year.

In addition to their work on "Science Indicators," Elkana, Merton, Thackray and Zuckerman compiled an annotated collection of 60 volumes, to be reprinted from works in and about science over a span of the past four centuries (12). The collection includes writings by and about scientists, such as Galileo, John Ray, Euler, W. R. Hamilton, Henry Cavendish and A. R. Wallace. The group undertook this project in the thought that the natural sciences have become of increasing public concern and, in some quarters, are no longer taken for granted as possessing self-evident worth. A renewed awareness of the diverse heritage of the modern natural sciences should help provide adequate perspectives on the newly-problematical status of science.

In choosing the material for this collection, the selectors embraced the historian's belief that to glimpse where we are headed we must know where we have been. This does not involve simple extrapolation from the past. Rather, guided by perspectives drawn from the related disciplines of the history, philosophy, and sociology of science, and heading toward an historical sociology of scientific knowledge, the selectors have searched out forgotten gems and occasionally, since they were significant in the development of science, influential mediocrities of past times. The collection is composed of biographies and autobiographies of scientists, historical and sociological accounts of scientific societies and other institutional science, interpretations of the interaction between science and society, *Festschriften* devoted to pioneers in the analytical study of the scientific enterprise, philosophical orientations to science, and accounts of the comparative development of science in differing social and political contexts, in times of war and of peace. The collection, titled *History, Philosophy and Sociology of Science: Classics, Staples and Precursors* will be published in June, 1975.

Members of this POSTS group focused another part of their work on the cognitive and social processes in the development of scientific knowledge. Having decided to work toward the goal of developing an analytical and interpretative framework through the study of cases in point, they elected to focus on the case of Joshua Lederberg's discovery in 1947 of sexual recombination in bacteria and his sub-

sequent research on transduction, which laid the foundation for the new specialty of bacterial genetics. The investigation is based upon focused interviews with participants in the scientific development, publications and unpublished documents, including a detailed personal account developed by Lederberg.

In a presentation to the American Association for the Advancement of Science, Lederberg outlined the case history to be investigated. From 1875 to 1945 most biologists believed that bacteria were asexual. This myth originated in 1675 when van Leuwenhoek observed protozoa copulating, but failed to find comparable evidence for sex in his microscopic observations of bacteria. In 1875 Ferdinand Cohn systematized the known data on the biology of bacteria, postulating the strict genetic stability of these organisms. Thus the myth of bacterial asexuality was established. Subsequently, the rapid separation of the disciplines of microbiology, as an applied medical subject of overwhelming human significance, from the main stream of basic academic biology, impeded a fundamental reexamination of these premises of microbiological science.

It took the renewal of evolutionary analysis in the 1940's, the generally greater social investment in scientific, and especially in biological research during and immediately after World War II and a variety of other social, historical, intellectual and personal factors to set the stage for the important discovery that bacteria recombine sexually.

Joshua Lederberg

One of Lederberg's many interests last year was the analysis of safety procedures for testing newly-invented drugs and food additives. In an article for *How Safe is Safe?* (19), he notes that many people balk vehemently at the idea of dealing with health in economic terms. Lederberg agrees that calculations of the proper dollar equivalent of a human life are nonsense. However, he emphasizes that economic calculations to achieve the most efficient *relative* allocation of resources for protecting our most precious goods are valid and necessary. We do not yet have much information about the costs or benefits of drugs and additives, and we have even less information about the impact of possible diseconomies of investment and innovation in the field of drugs and additives. It is *not* reasonable to demand across-the-board evidence that substances have no carcinogenic effects for example (*all* food has *some* such effect), but it is reasonable to ask whether the benefits of a substance are commensurate with its possible insidious risk to health. Lederberg states that we need to consciously calculate costs and benefits and put our estimates on the table.

Using such estimates, improvements in efficiency could be made in the testing of new drugs. For example, routine testing may result in very costly and unnecessary expenditures for the validation of an additive or a drug (including the cost of the delay in not receiving the drug's benefits). Current regulations do not require thoughtful

analysis of the metabolism of a new agent, although this would in many cases be more efficacious and efficient than only using large numbers of routine tests.