THE LEGACY OF JONAS SALK

Jonas Salk, best known as the developer of the first successful vaccine against paralytic poliomyelitis, also made many other contributions in the fields of medicine and biology, philosophy, and even architecture. He named and was responsible for many advances in the field of vaccinology, he was an advocate for the practical application of scientific research, he founded one of the major institutions of biological research in the world today (creating architectural history through his collaboration with Louis Kahn), he developed an evolutionary, metabiological view of human life and society, he was one of the founders of the field of psychoneuroimmunology, and he made an important impact in philanthropy through his involvement as a director of the MacArthur Foundation. Finally, he has made an important contribution to the history of medicine by having collected one of the largest, most complete personal archives of a twentieth century scientist.

As a child, his serious concerns were about injustices in life and he hoped to bring about justice through the study of law and by becoming a member of Congress. Upon entering the City College of New York, however, he became interested in science and medicine, which dominated his subsequent career. After completing medical school at the New York University College of Medicine and an internship at Mt. Sinai Hospital in New York City, he entered research rather than the private practice of medicine, hoping to be able to help many rather than a few. His earliest concerns remained with him and he expressed them through biology and medicine rather than through law.

Vaccinology --

From the time he was a medical student he questioned the dogma that immunity against a virus disease could only be induced by a living virus. If bacterial toxins, such as those produced by tetanus and diphtheria, could be modified into nontoxic "toxoids" that would induce immunity against the original toxin, why could not viruses be rendered noninfectious (inactivated or killed) and still induce immunity? Through his contributions in the 1940s to the development of the first successful inactivated vaccines against influenza in the laboratory of Dr. Thomas Francis at the University of Michigan and his subsequent development of an inactivated poliovirus vaccine at the University of Pittsburgh in the early 1950s, Jonas Salk established that noninfectious vaccines could indeed protect against viral diseases. The principal he advocated was that inducing immunity to disease depends on the proper presentation of the proper antigen to the immune system; the ability of a virus to infect or replicate is not necessary for the induction of protective immunity. His work made possible the modern array of vaccines made from noninfectious materials, including killed whole viruses or parts of viruses.

In 1977, he tried to bring a broader immunological perspective to the discussion of vaccines rather than the limited virological perspective that then prevailed. He introduced the term "vaccinology" to describe the development of effective vaccines based on "the requirements for inducing immunity against an infectious disease" rather than simply the creation of virus-specific antibody. He pointed out that it is necessary to understand what "immunity against disease" means for each specific disease, what will actually protect against morbidity and what "control" means for each disease. Theoretical scientific assumptions must be revisited based on actual

experience. Because many decisions about immunization policy are based on social, political, technological and economic factors in addition to medical and scientific factors, "the basic requirements for effective immunization" must include an understanding of these issues as well.

In 1987 he proposed a novel idea: a "therapeutic" inactivated vaccine to control the acquired immune deficiency syndrome (AIDS) in persons already infected with the human immunodeficiency virus (HIV). Until his death in 1995, he continued work on this vaccine as both a therapeutic vaccine and as a preventive vaccine for individuals not yet exposed. This vaccine is currently being tested in clinical trials.

Poliomyelitis and Public Health --

The inactivated poliovirus vaccine was tested in 1954 and released for general use in 1955. Within six years, the incidence of paralytic poliomyelitis in the United States was reduced by 95%. In other countries where the inactivated vaccine continued to be used exclusively, paralytic poliomyelitis also disappeared. What had been one of the most frightening epidemics of the twentieth century was brought under control. Techniques established by Jonas Salk for virus typing, virus culture and principals of vaccine manufacture continue to be used today.

In the late 1970s he returned to studies of poliomyelitis and began successful collaborations to standardize and produce an inactivated poliovirus vaccine that would be reproducibly effective in a single dose and could be combined with other routine childhood immunizations, such as diphtheria-tetanus-pertussis (DTP) vaccine. An inactivated vaccine with these properties would provide many benefits in the developing world, where live oral poliovirus vaccine was less effective than had been hoped. In 1977 Jonas Salk first suggested that poliovirus could be eradicated from the world, a goal formally adopted by the World Health Organization in the 1990s.

Biology and Society --

In 1960, Jonas Salk announced plans to establish an institute dedicated to "the advancement and dissemination of knowledge relevant to the health and well-being of man by research, advanced instruction, and training (a) in biology, (b) in the cause, prevention, and cure of disease, and (c) in the factors and circumstances conducive to the fulfillment of man's biological potential." The Salk Institute for Biological Studies began work in 1963 and is now one of the preeminent biomedical research institutions in the world today. The buildings that house the Salk Institute were designed by the noted American architect Louis Kahn; the great rapport and collaboration between Jonas Salk and Louis Kahn resulted in an environment and structures that have influenced subsequent architectural thinking and laboratory design.

In 1961, Jonas Salk presented a lecture at the Massachusetts Institute of Technology entitled "Biology in the Future." In this and subsequent lectures he observed analogies between the development and function of the central nervous system and the immune system. He hypothesized interrelationships among the genetic system, the immune system, the nervous system and behavior. In this respect, he was one of the founders of the field of psychoneuroimmunology, the study of how mind, nervous system and immune system work together.

Between 1972 and 1983, Jonas Salk published four books of essays on human life and the nature of evolution. He lectured widely and was the author of many other short papers on these subjects. His perspective as a scientist and his interest in the relationship between art and science led him to unique explorations of personal and social evolution. He was deeply interested in the fulfillment of man's biological potential and man's place in what he referred to as the metabiological world. In lectures and seminars and private discussions, he applied these intellectual concepts to practical social issues. Through his role as a Director of the MacArthur Foundation, he helped to create the MacArthur Fellowship Program, a new approach to philanthropy, and he influenced the Foundation's support of health related issues. In 1986 he established The Jonas Salk Foundation, a nonprofit organization dedicated to the advancement, dissemination and encouragement of practical application of knowledge relevant to (a) the fulfillment of the human creative potential, (b) the enhancement of human health and well being, and (c) the prevention of crippling and death attributable to human conduct or other causes.

His personal archives, now housed at the University of California, San Diego, are one of the largest, most complete manuscript collections of a twentieth century scientist.

NOTE: This essay also appears in Milestones of the 20th Century (Danbury: Grolier, 1999, pp. 80-81).