

Obituary

JESSE PHILIP GREENSTEIN

1902–1959

The death of Jesse Philip Greenstein on February 12, 1959, closed the career of a most distinguished scientist, whose numerous magnificent contributions to the fields of biochemistry and cancer enriched our knowledge, stimulated our imaginations, and opened new paths for exploring the complexities of natural phenomena. Those privileged to be associated with him lost a true friend and counselor, an outstanding leader sincerely interested in his colleagues as people as well as scientists. His influence on the course of biomedical research and on the organization of which he was so important a member endures.

Dr. Greenstein was born in New York City in 1902. After graduating from the public schools, he worked for 2 years as a technician for the New York City Department of Health, and earned a B.S. in Chemistry with honors from the Polytechnic Institute of Brooklyn in 1926. The next year was spent working as an analytical chemist in a commercial laboratory, but he then entered the graduate school of Brown University, was awarded a Sharpe Fellowship, and received his Ph.D. in 1930. A National Research Council Fellowship enabled Dr. Greenstein to spend a year with Professor E. J. Cohn at the Harvard Medical School and another year with Professor M. Bergmann at the Kaiser Wilhelm Institute in Dresden, Germany. After serving as a research associate in biochemistry at the University of California in Berkeley, Dr. Greenstein returned to Harvard in 1933, where he remained as Instructor and Tutor in Biochemical Science and assistant to Professor L. J. Henderson until he joined the staff of the newly formed National Cancer Institute in 1939.

The group of investigators at Bethesda was comparatively small, unusually talented, and extremely vigorous. Almost every conceivable aspect of experimental cancer research was debated in detail and with considerable fervor. Dr. Greenstein rapidly earned the respect of his colleagues through his precise knowledge of chemistry, his mature judgment, and his unusually lucid exposition and argument. His position of leadership in the Institute, where he became the first Chief

of the Laboratory of Biochemistry in 1946, soon extended far beyond the Bethesda campus, as the products of his research excited the interest of biochemists and students of cancer throughout the world. Young men, many of them from foreign lands, flocked to his laboratory in increasing numbers.

One of his close associates has written of Dr. Greenstein: "He was a living dynamo, primed with a source of energy that permitted him to work at a vigorous pace for 16–18 hours a day, 7 days a week, and the only waste product of which was the smoke which emerged from a seemingly endless chain of cigars. This boundless energy, coupled with a firm, yet understanding and jovial nature, was a continual source of inspiration to his younger scientific associates whose eager compulsion to follow his lead from example led them to scientific achievements of which they had believed themselves incapable." Many of those people now hold responsible positions in prominent academic and research institutions.

Dr. Greenstein's first contribution to scientific knowledge in 1930 was concerned with peptide chemistry, and his intense interest in proteins and their precursors continued throughout his career. His fascination with biological problems grew steadily in the National Cancer Institute, where initially he sought chemical differences between neoplasms and their tissues of origin. Extensive study of enzymic activities permitted generalizations that express the concept of anaplasia in biochemical terms. He was also interested in effects of growing neoplasms on their hosts, especially the depression of hepatic catalase. Dr. Greenstein's grasp of the intricacies of cancer was enormous, and his work, *Biochemistry of Cancer*, which appeared first in 1947 and in second edition during 1954, is one of the most significant and widely quoted references in the enormous literature on neoplastic diseases.

The decided preference which mammals exhibit for levorotatory amino acids led this great scientist, using enzyme methods developed in his laboratory, to devise a practical means of resolving racemic mixtures of amino acids into their optical-

ly active forms to facilitate studies of protein chemistry and metabolism. The project was completely successful within a period of 5 years, but refinements in technics continued to effect greater economies in amino acid production. Availability of pure, optically active amino acids permitted synthesis and studies of peptides with known configuration, investigation of the caprice or specificity of peptidases, and pharmacological studies that established the role of arginine in detoxification of ammonium ions. Even more important was the design of a chemically defined diet for the laboratory rat that Dr. Greenstein and his associates used in imaginative nutritional experiments, which also provides the finest opportunity yet afforded to study pathways of intermediary metabolism in intact subjects, which Dr. Greenstein recognized full well.

Such important contributions to knowledge entailed the preparation of over 200 individual reports which were written in flawless English by the simple expedient of pushing his pencil over paper at the steady rate of three pages an hour. His last work, a definitive treatise on amino acids with Dr. Milton Winitz, was almost complete at the time of his death and will appear next year. His literary and scientific attainments earned him service on the editorial boards of *Cancer Research*, *Archives of Biochemistry and Biophysics*, and co-editorship with Professor Alexander Had-

dow of *Advances in Cancer Research*. He was a member of the American Association for Cancer Research, the American Society of Biological Chemists, and the American Chemical Society, in which he was Chairman, Division of Biological Chemistry during 1955.

Recognition came to Dr. Greenstein in several different ways. He was Visiting Professor of Biochemistry at the University of California in 1948, and a Visiting Lecturer at several Japanese Universities during 1956, when he became an Honorary Member of the Japanese Biochemical Society and the Japanese Foundation for Cancer Research. He participated in a Conference on Cancer at the Papal Academy in Vatican City in 1949; received the Neuberg Medal in Biochemistry in 1950; the Distinguished Service Award of the U.S. Department of Health, Education and Welfare in 1954; the Certificate of Achievement from his alma mater, Polytechnic Institute of Brooklyn, in 1956; and the Hillebrand Award of the American Chemical Society in 1958. His greatest recognition, however, is the esteem in which he is held by his wide circle of professional associates and colleagues, and the fond memories of his many friends.

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