The Journal of Immunology

In Memoriam Elvin Abraham Kabat September 1, 1914–June 16, 2000

Donald M. Marcus and Stuart F. Schlossman

J Immunol 2001; 166:3635-3636; ;
doi: 10.4049/jimmunol.166.6.3635
http://www.jimmunol.org/content/166/6/3635

The Journal of Immunology is published twice each month by
The American Association of Immunologists, Inc.,
1451 Rockville Pike, Suite 650, Rockville, MD 20852

Print ISSN: 0022-1767 Online ISSN: 1550-6606.

In Memoriam
Elvin Abraham Kabat
September 1, 1914–June 16, 2000

Elvin A. Kabat, Ph.D., one of the great immunologists of the 20th century, died on June 16, 2000 at the age of 85 in Falmouth, Massachusetts. It is not possible, in this brief memorial, to do justice to Dr. Kabat's scientific accomplishments. During a career of almost seven decades he published approximately 400 papers, and many books including *Experimental Immunochemistry*, *Structural Concepts in Immunology and Immunochemistry*, *Blood Group Substances—Their Chemistry and Immunochemistry*, and *Variable Regions of Immunoglobulin Chains.*

Dr. Kabat graduated from the City College of New York at the age of 18 in 1932. His graduate studies of the immunochemical and physical properties of antibodies were performed in the laboratory of Dr. Michael Heidelberger in the Department of Biochemistry at Columbia University College of Physicians and Surgeons. After receiving his Ph.D. in 1937, he spent a postdoctoral year in the laboratories of Professors The Svedberg and Arne Tiselius at the Institute of Physical Chemistry, in Uppsala, Sweden. This period, from 1932 to 1938, produced a series of key studies that molded Kabat's scientific career. Heidelberger and Kabat played a major role in the evolution of immunology from a descriptive field into a quantitative chemical discipline. They advocated the precise quantification of antigen-antibody interactions and performed pioneering studies using new physical chemical techniques to characterize antibody molecules. These studies included the relationship between serum agglutinin and precipitin reactions, the quantification of cross reactions, and the demonstration that purified antibodies were gammaglobulins by moving boundary electrophoresis and could be separated by ultracentrifugation into 19s and 7s populations. These studies provided the first critical insights into the physical properties and heterogeneity of antibodies.

In 1938 Kabat returned to New York as an Instructor in Pathology at Cornell University and in 1941 moved to Columbia University College of Physicians and Surgeons, where he subsequently was appointed to Professorships in Microbiology and Human Genetics and Development. In the earliest stages of his career, World War II constrained his work, but despite his commitment to the war effort he was still able to make a number of important contributions to the quantitation of anaphylaxis, to the nature and purification of plant toxins, and to the immunochemical analysis of proteins. At the end of the war, he began a series of pioneering studies in new areas, including the immunochemistry of the ABO blood group substances, the production of acute allergic encephalomyelitis in monkeys, and the relationship of experimental autoimmune encephalomyelitis to multiple sclerosis. These latter studies initiated Kabat's long-term interest in autoimmunity and in the development of clinical assays for multiple sclerosis. This initial span of his scientific career is recounted in his paper entitled "Getting started 50 years ago—experiences, perspectives and problems of the first 21 years" (*Annu. Rev. Immunol. 1:1–32, 1983*). In this reminiscence, he relates in a vivid manner the difficulties of living through the depths of the depression, the Spanish Civil War, World War II, and reveals his extraordinary courage and integrity during the McCarthy era.

With permission, from the Annual Review of Immunology, Volume 1, © 1983, by Annual Reviews www.AnnualReviews.org

In the early 1950s, Dr. Kabat began his pioneering work on the dextran-antidextran system by analyzing allergic reactions to dextrans used as blood expanders. After demonstrating that the hypersensitivity reactions were indeed directed at dextran carbohydrate, and not, as previously assumed, at protein contaminants, he recognized the importance of using single structurally well-defined molecules for analysis of antigenic determinants and antibody specificity. His studies led him to conclude that antibodies against dextran could recognize structures as small as di- and trisaccharides, and as large as a hexasaccharide. He also suggested, based on studies of linear and branching dextrans, that some antibody combining sites were cavities that recognized the terminal nonreducing ends of carbohydrate chains, and other antibody binding sites were grooves, which permitted them to bind to internal structures of extended carbohydrate structures. These predictions, based on studies of heterogeneous polyclonal antibodies, were verified by his subsequent studies of monoclonal antibodies, and by crystallographic studies performed by other scientists several decades

0022-1767/01/$02.00

later. He garnered a wealth of information on antibody responses from his studies of the dextran-antidextran and blood group systems.

His analytic skills came to the forefront in the 1970s when, as a consequence of the analysis of the peptide sequence of a large number of Ig molecules, he recognized the existence of hypervariable and framework regions in the V region domain of the Ig molecule. Moreover, he suggested that these two different types of residues in the V region subserved different functions and that the framework regions were involved in three-dimensional folding, whereas the hypervariable regions were intimately involved in the antibody-binding site or complementarity-determining regions. Affinity labeling and x-ray crystallographic studies have confirmed many of his earlier predictions.

Scientists and students came from all over the world to work with Dr. Kabat, and many people who trained with him became leaders in glycobiology and immunology. His passion for science, integrity, and high standards made him a demanding taskmaster, and his critiques of experimental data could be unsparing. His former trainees enjoyed getting together at international meetings to reminisce about their experiences in his laboratory and what it meant to be "Kabatized." Kabat's wonderful sense of humor and his talent as a raconteur leavened the serious atmosphere of the laboratory. Scientists who trained in his laboratory carried with them a model of how science should be performed, and his trainees maintained enduring personal and professional relationships with him.

His scientific accomplishments were recognized by awards and honorary degrees too numerous to list. Among these awards were election to the National Academy of Sciences, the Louisa Gross Hurwitz Prize from Columbia University, which he shared with Dr. Heidelberger and Dr. Henry Kunkel, and the United States' highest award for scientific achievement, the National Medal of Science. The scientific community has lost one of its greatest and most committed members. On behalf of all his former associates and colleagues, we would like to extend our sympathy to his family, and to celebrate with them a life of remarkable achievement.

Donald M. Marcus
Stuart F. Schlossman