18. A. M. Pappenheimer, Jr., M. Scharff, J. W. Uhr, in *Mechanisms of Hypersensitivity*, J. H. Shaffer *et al.*, Eds. (Little, Brown, Boston, 1959), p. 417.
19. F. Karush, in *Advances in Immunol.*, in press.
20. ———, *J. Am. Chem. Soc.* **78**, 5519 (1956).
21. B. Benacerraf and P. G. H. Gell, *Immunol.* **2**, 53 (1959).
22. S. B. Salvin, personal communication; B. H. Waksman, *J. Allergy* **31**, 468 (1960).
23. D. W. Talmage, *J. Infectious Diseases* **107**, 115 (1960).
24. B. Chance, in *Enzymes and Enzyme Systems*, J. T. Edsall, Ed. (Harvard Univ. Press, Cambridge, Mass., 1951).
25. B. H. Waksman, in *Cellular and Humoral Aspects of the Hypersensitive States*, H. S. Lawrence, Ed. (Harper, New York, 1959), p. 123.
26. F. G. Germuth, A. E. Maumenee, J. A. Pratt-Johnson, L. B. Senterfit, C. E. Arnon, A. D. Pollack, in *Mechanisms of Hypersensitivity*, J. H. Shaffer *et al.*, Eds. (Little, Brown, Boston, 1959), p. 155; J. J. Parks, H. M. Leibowitz, A. E. Maumenee, *J. Immunol.* **87**, 199 (1961).
27. S. Raffel, L. E. Arnaud, C. D. Dukes, J. S. Huang, *J. Exptl. Med.* **90**, 53 (1949).
28. H. N. Eisen and M. Tabachnick, *ibid.* **108**, 773 (1958).
29. S. Rothman, *Physiology and Biochemistry of the Skin* (Univ. of Chicago Press, Chicago, 1954), p. 63.
30. H. N. Eisen, L. Orris, S. Belman, *J. Exptl. Med.* **95**, 473 (1952); H. N. Eisen and S. Belman, *ibid.* **98**, 533 (1953).
31. K. Landsteiner and M. W. Chase, *ibid.* **66**, 337 (1937); P. G. H. Gell, *Brit. J. Exptl. Pathol.* **25**, 174 (1944); M. W. Chase, *Intern. Arch. Allergy Appl. Immunol.* **5**, 163 (1954).
32. H. N. Eisen, M. Kern, W. T. Newton, E. Helmreich, *J. Exptl. Med.* **110**, 187 (1959).
33. F. S. Farah, M. Kern, H. N. Eisen, *ibid.* **112**, 1195 (1960).
34. P. G. H. Gell and B. Benacerraf, *ibid.* **113**, 571 (1961); B. Benacerraf and P. G. H. Gell, *Immunol.* **2**, 219 (1959); K. Landsteiner and M. W. Chase, *J. Exptl. Med.* **73**, 431 (1941). In the experiments cited here, as well as in those with DNP-conjugates cited in *32*, dead mycobacteria were included in the emulsions injected to induce sensitivity. If mycobacteria are omitted, there is apparently little, if any, induction of contact sensitivity of the skin (M. W. Chase, personal communication). Salvin and Smith [*J. Exptl. Med.* **114**, 185 (1961)] have recently described the induction of contact sensitivity of the skin through injection of DNP-conjugates (with mycobacteria) made from soluble extracts of guinea-pig skin or from guinea-pig erythrocyte stroma. Their results conform to the theoretical analysis in the text.
35. L. Brent, J. Brown, P. B. Medawar, *Lancet* **2**, 561 (1958).
36. J. M. Weaver, G. H. Algire, R. T. Prehn, *J. Natl. Cancer Inst.* **15**, 1737 (1955).
37. D. B. Amos and J. D. Wakefield, *ibid.* **21**, 657 (1958); G. H. Algire, J. M. Weaver, R. T. Prehn, *Ann. N.Y. Acad. Sci.* **64**, 1009 (1957).
38. C. A. Stetson, in *Mechanisms of Hypersensitivity*, J. H. Shaffer *et al.*, Eds. (Little, Brown, Boston, 1959), p. 572; P. A. Gorer, *Advances in Cancer Research* **4**, 149 (1956); G. W. Siskind and L. Thomas, *J. Exptl. Med.* **110**, 511 (1959); P. I. Terasaki, E. J. Bold, J. A. Cannon, W. P. Longmire, *Proc. Soc. Exptl. Biol. Med.* **106**, 133 (1961).
39. G. H. Algire, *J. Natl. Cancer Inst.* **23**, 435 (1959); D. B. Amos and J. D. Wakefield, *ibid.* **22**, 1077 (1959).
40. R. A. Good, R. A. Bridges, S. J. Zak, A. M. Pappenheimer, Jr., in *Mechanisms of Hypersensitivity*, J. H. Shaffer *et al.*, Eds. (Little, Brown, Boston, 1959), p. 467.
41. D. Gitlin, C. A. Janeway, L. Abt, J. M. Craig, in *Cellular and Humoral Aspects of the Hypersensitive States*, H. S. Lawrence, Ed. (Harper, New York, 1959), p. 375.
42. This work was supported, in part, by research grants (H-6293, E-3231) from the National Institutes of Health, and by a contract with the Office of the Surgeon General, Department of the Army, on the recommendation of the Armed Forces Epidemiological Board. We have profited considerably in the formulation of this theory from discussions with many colleagues, particularly at the Marine Biological Laboratory, Woods Hole, Mass., where the manuscript was largely completed during the summer of 1961.

Richard Joseph Block, Biochemist

Richard J. Block and his wife, together with Dr. and Mrs. Jerome A. Uram and 14 other persons, died in a plane crash on 4 February 1962, shortly after leaving Tingo María, Peru. The Americans were on a mission sponsored by the National Institutes of Health in connection with the International Program on Nutrition Studies. Characteristically, Dick Block was also interested in securing a collection of drug plants from remote areas of Peru, which, according to Theodor Binder of the Hospital Amazonico Albert Schweitzer, Pucallpa, Peru, showed promise in the alleviation of human cancer.

Throughout 32 years of continuous research in the biochemistry of amino acids and proteins, Block customarily worked on several projects simultaneously. He was aware of the staggering amount of work that still lay ahead. He was never satisfied with what he himself accomplished. His friends and colleagues often heard him say that he "retired" in 1934. What Dick accomplished in his "retirement" during these 28 years is recorded in 128 published papers, a score of patents, and four textbooks of which he was the principal author. He also contributed chapters to a number of reference volumes.

Block left numerous projects "on the fire," which are being continued by his collaborators. These include several projected books and monographs, some of which were left in the final stages of preparation. Most important of all, he left behind him friends who deeply feel the loss of such a rare human being. This was his greatest achievement. "To make and keep a friend in our lifetime is the sole purpose of our lives."

He was born in Macon, Georgia, on 4 May 1906 and received his B.S. in chemistry at Yale in 1928 and his Ph.D. in physiological chemistry at Yale in 1931. In 1930 he married Peggy Strasser of New York. After serving as a fellow at Yale, he went to Munich, Germany, to the laboratory of F. von Müller.

Before joining the New York State Psychiatric Institute and Hospital as a research associate, Block had his interests in the fields of research in biochemistry well defined, and these interests remained with him to his last day: the amino acid composition of proteins in relation to their biological properties and nutritive value; and the biological synthesis and the interconversion of amino acids, their comparative biochemistry and relationship to health and disease.

In 1932, in collaboration with G. R. Cowgill, he published five reports on the preparation and purification of a highly potent preparation of thiamine (then known as vitamin B_1). This highly active field at that time occupied the minds of numerous biochemists throughout the world, and Block was making valuable contributions to the subject. But, characteristically, his mind and heart were in his beloved amino acids, and he would do only what his mind and heart told him to do. At that time, cystine reigned supreme as the only indispensable sulfur amino acid in animal nutrition, although J. H. Mueller had isolated another sulfur amino acid, later named methionine, which challenged the supremacy of cystine.

In collaboration with R. W. Jackson, Block convincingly demonstrated that methionine can indeed substitute for cystine in a cystine-low diet for rats, and he suggested several lines of investigation directed toward further elucidation of the problems which arose from this fundamental observation. Can methionine be converted in vivo to cystine, and if so, by what pathway? Does methionine furnish only its sulfur in the elaboration of cystine? Can methionine serve as the sole sulfur amino acid in the diet? Is methionine convertible to cystine in cystinurics and in the production of mercapturic acids?

For several "sulfur men" of those days these problems initiated an extraordinary number of research projects. To appreciate the staggering difficulties which confronted them one should recall that the 1930's and 1940's were periods of "labor pains" for biochemistry.

At a time when tracer methodology was only a gleam in the eye of the biochemist, one's ingenuity and imagination had to be strained to the utmost in order to design and execute experiments which would be next best to a direct demonstration of the convertibility of one metabolite into another. In collaboration with E. Brand and others, Block investigated the feasibility of employing cystinurics for the elucidation of the pathway of conversion of methionine to cystine. In the course of one of their "fits of imagination," Block and his co-workers proposed a scheme for the conversion of methionine to cysteine by way of the process of transulfuration, with the intermediate formation of S-(alpha-carboxy-aminoethyl) homocysteine from homocysteine and serine through the formation of aminoacrylic acid from serine. The essential correctness of the scheme was later brilliantly demonstrated by du Vigneaud and his collaborators, who employed ingenious methods of organic chemistry and tracer methodology.

Characteristically, encouraged by the spree staged by the "sulfur men," Block plunged into other fields of work and investigated the metabolism of phenylalanine in phenylpyruvic acid oligophrenics, continued his early work on the comparative biochemistry of the basic amino acids, tested the availability of L- and D-methionine and their N-formyl derivatives for the growth of rats, evolved several methods for the chemical determination of amino acids, and devoted all his spare time to the compilation of analytical and preparative methods for studying the amino acids and proteins in animal and plant tissues. The resulting book, *The Amino Acid Composition of Proteins and Foods*, proved to be extremely useful throughout the world; it went through several editions and was translated into foreign languages.

Richard Joseph Block. [Kaiden-Kazanjian]

After World War II, Block's interest shifted with great intensity to chromatography. His experiments were conducted in a laboratory in his home, where he could explore this relatively new field in his spare time, uninterrupted and uninhibited by protests against the obnoxious volatility of some of the solvents which he employed. This activity, directed mainly toward refining the procedures then available and toward securing more information about the composition of proteins and foods, did not keep him from establishing, in collaboration with H. H. Mitchell, the correlation of the amino acid composition of proteins with their nutritional value, or from investigating the effects of various practices followed in the preparation of foods for human consumption on the nutritive value of certain amino acids, particularly lysine and the sulfur amino acids. In the 1950's he projected and carried out, in collaboration with others, the synthesis of the sulfur amino acids from inorganic sulfate in ruminants, such as the cow, the goat, and the ewe. Later, as a member of the Boyce Thompson Institute, Block carried out a series of similar studies in yeast and insects.

While engaged in these activities, Block found time and energy to serve as professorial lecturer at New York Medical College and as consultant to numerous industrial organizations, with one of which, the Borden Company, he was associated for 24 years. He was also a visiting professor in the department of physiology and biochemistry, and an associate member of the Bureau of Biological Research, of Rutgers University; chairman of the Sub-Committee on Amino Acids of the Committee on Biological Chemistry of the National Research Council; and a member of the Nutrition Study Section of the National Institutes of Health.

In the past 5 years Block had devoted his efforts to further development of the "anlage" hypothesis (which he proposed in 1933 in regard to the structure and behavior of the serum proteins) which postulates that certain structures of relatively constant composition are common to all the serum proteins. In collaboration with several other workers Block produced considerable experimental evidence to show that the discrepancy between the findings with I^{131} and with I^{127}, with human serum, are such that radioactive iodide as usually employed cannot be used to measure the distribution of iodoamino acids in serum. He continually revised, tested, and applied methods to resolve this highly controversial and important point, practically up to the last days of his life.

Block is survived by two daughters, Mrs. Werner Krebser and Mrs. Thomas Montie. Ralph Holman of the University of Minnesota, who was in Lima on a mission similar to that of Block and Uram, writes: "I delayed my departure from Lima in order that I could attend the funeral, for I had ascertained from the American Consul the interment was to be in Lima and none of the families would be present. The ceremony was simple and beautiful. Ambassador James Loeb spoke on behalf of the government and recounted the accomplishments of the deceased and their mission to Latin America. Dr. Orlando Olsese, President of the Universidad Agraria in Peru, next spoke on behalf of the Peruvians, expressing the gratitude they hold for Drs. Block and Uram in coming to aid in the relief of the nutritional problems of the country. He expressed the grief of the Peruvian scientists in the untimely loss of such friends."

JAKOB A. STEKOL
Institute for Cancer Research, Philadelphia, Pennsylvania

HARTLEY W. HOWARD
Borden Special Products Company, Division of the Borden Company, New York