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PROFESSOR WILLIAM ZEV HASSID

This issue of *Carbohydrate Research* is dedicated to the memory of Professor William Zev Hassid who died on April 28th, 1974; it contains contributions from his friends and associates in the field of carbohydrate chemistry.

He was born in Jaffa, Palestine. From the age of 4 to 15 years, he lived in Kremenetz in the Russian Ukraine and then returned to Palestine where he completed high school and later served for two years (1918–1920) in the British Army. On the advice of a friend, he came to the United States with the intention of studying agronomy at the University of California. However, he first worked for a year to accumulate funds for his education. Indeed, throughout his college career, he supported himself with jobs in the city, on farms, or later as a research assistant at the university. Because of his limited knowledge of English, he spent one term at Fresno Junior College before entering the University of California in August, 1922. He obtained his A.B. in Chemistry (1925), his M.S. in Plant Nutrition (1930), and his Ph.D. in Plant Physiology (1934). He joined the staff of the Department of Plant Nutrition in 1935 as a Junior Chemist in the Agricultural Experiment Station; he became Instructor in 1939, and rose to the rank of Professor of Plant Biochemistry in 1947; in 1959, he transferred to the Biochemistry Department, and in 1965 he became emeritus from his academic position. He has continued until the present to carry on research on polysaccharide synthesis as a member of the Agricultural Experiment Station.

His interest in carbohydrate chemistry was initially aroused through contacts with Professor Walter H. Dore. During outings at beaches near San Francisco, Hassid observed large quantities of fleshy marine algae and decided to investigate their polysaccharides for his Ph.D. thesis. He isolated a sulfuric acid ester of a galactan from *Irideae laminarioides* and, by application of the methylation methods developed by W. N. Haworth, he determined the primary structure of the polysaccharide. Following this study, he initiated comparative studies of the structure of starch and glycogen from various plants and animal sources and established the relative amounts of linear and branched D-glucose polymers. In collaboration with Gerty T. Cori and R. M. McCready, he showed that the polysaccharide formed from D-glucosyl phosphate by purified muscle phosphorylase has an unbranched structure; similar results were obtained with products formed by plant phosphorylases.

In 1939, Hassid collaborated with S. Ruben and M. D. Kamen in the first application of radioactive carbon (^{11}C) in biological research. When ^{14}C became available, he and his associates pioneered in the development of biological methods for the preparation of uniformly ^{14}C-labeled carbohydrates, including D-glucose, D-fructose, D-galactose, sucrose, and starch. Beginning in 1943, he collaborated with M. Doudoroff, N. O. Kaplan, and H. A. Barker in a series of investigations on the

phosphorolysis and synthesis of sucrose by an enzyme from *Pseudomonas saccharophila*. These studies not only demonstrated the enzymic synthesis of sucrose and related disaccharides for the first time, but also provided strong evidence for the existence of a glycosyl–enzyme intermediate. Subsequent efforts to show the presence of a similar enzyme in plants were unsuccessful until L. Leloir and his associates discovered the uridine diphosphate sugars and demonstrated the synthesis of sucrose from UDPG and D-fructose or D-fructose 6-phosphate. Hassid and his associates then undertook a systematic investigation of the occurrence of nucleoside diphosphate sugars in higher plants. They isolated nucleoside diphosphate derivatives of D-xylose, L-arabinose, D-galactose, D-galacturonic acid, D-mannuronic acid, and 2-acetamido-2-deoxy-D-glucose, and established the roles of several of these compounds in sugar interconversions or polysaccharide formation. With D. S. Feingold and E. F. Neufeld (1958), he demonstrated the synthesis of a (1→3)-β-D-glucan (callose) from UDPG by a soluble enzyme, and with R. A. Dedonder he reported the synthesis of a (1→2)-β-D-glucan from UDPG by an enzyme preparation from *Rhizobium japonicum*. With A. D. Elbein and G. A. Barber (1964), he achieved the enzymic synthesis of cellulose from GDPG with a particulate preparation from mung-bean seedlings. Although most of Hassid's research was concerned with saccharide metabolism in plants, he also elucidated the synthesis of lactose in animals. With W. H. Watkins (1962), he showed that a particulate enzyme preparation from mammary-gland tissue forms lactose from UDP-galactose plus D-glucose, rather than from UDP-galactose and α-D-glucopyranosyl phosphate, as previously proposed. H. Babad and Hassid (1964) subsequently discovered the soluble lactose-synthesizing enzyme-system in bovine milk that was later found by K. E. Ebner and others to consist of two proteins, α-lactalbumin and *N*-acetyllactosamine synthetase.

Hassid received the Sugar Research Award (1945) of the National Academy of Sciences (jointly with M. Doudoroff and H. A. Barker), the Charles Reid Barnes Honorary Life Membership Award of the American Society of Plant Physiologists (1964), and the C. S. Hudson Award of the American Chemical Society (1967). He was honored at the 6th International Symposium on Carbohydrate Chemistry (1972) as one of three outstanding senior American carbohydrate chemists. He is a member of the National Academy of Sciences and the American Academy of Arts and Sciences. He served as Chairman of the Division of Carbohydrate Chemistry (1949–50) of the American Chemical Society, and as a member of numerous editorial boards.

For many years, Zev has been our close friend and colleague. His personal warmth and generosity, coupled with his scientific acumen and modesty, have attracted many friends and collaborators who owe much to him in their scientific and personal lives. We take this opportunity to salute him for his scientific accomplishments and to express our appreciation of his friendship.

H. A. BARKER
M. DOUDOROFF