

# Henry Borsook

1897-1984

**H**ENRY BORSOOK, professor emeritus of biochemistry, died of cancer in Santa Barbara, California, on March 6, 1984. He was 86.

Borsook was born in London, England, but moved with his family to Toronto, Canada, in 1907. He entered the University of Toronto as an undergraduate in 1917 and left in 1927 with a BA in physiology and biochemistry, a PhD in biochemistry, and the medical degree of MB (later converted to MD). His university career was marked by many honors, including the Faculty of Medicine Gold Medal on his graduation from medical school.

After graduating, Borsook spent two years as research fellow and lecturer in biochemistry at Toronto. In 1929 he was appointed assistant professor of biochemistry in the division of biology at Caltech, which had been founded the year before by Thomas Hunt Morgan. Borsook remained at Caltech until his retirement in 1968 at age 70. Not ready to give up work in the laboratory, he accepted an appointment at Berkeley, where he continued to do research until 1977.

The biochemistry of protein synthesis was one of the major themes of Borsook's scientific life. When he started his career, notions of the mechanism of protein synthesis were primitive by modern standards. No protein had been sequenced, the idea that the properties of proteins rested on unique sequences of amino acids was at best hypothetical, and the concept that an input of sequence information is essential for protein synthesis was still in the future. Borsook's earliest papers deal with the synthesis of a protein-like material by the action of the proteolytic enzymes pepsin and trypsin on a concentrated solution of the products of hydrolysis of egg albumin. The product, called "plastein," was thought to result from reversal of the hydrolytic action of the enzymes and to be relevant to the normal process of protein synthesis. Borsook himself later disproved this idea when, at Caltech, he initiated a program to measure the free energies of formation of biologically important compounds, in collaboration with Hugh M. Huffman. He found that energy is required for



protein synthesis from amino acids and that no significant reversal of the action of proteolytic enzymes is possible under the conditions that obtain in cells. This was perhaps his most important contribution to the general theory of protein synthesis. Later in his life he worked extensively on the role of the hormone erythropoietin in the cellular transformations that lead to the synthesis of hemoglobin.

Human nutrition was another subject of interest to Borsook. In the 1930s he carried out studies on the effects on human beings of B vitamins, especially B-1, in collaboration with the Institute physician, Dr. M. Y. Kremers. Old-timers can remember the clinic that was held weekly in Dr. Kremers' office on the first floor of Kerckhoff Laboratories, where massive doses of vitamin B-1 were administered to patients with trigeminal neuralgia (tic douloureux). During the war, Borsook was appointed to the Food and Nutrition Board of the National Research Council and to numerous other boards and commissions advising federal and state government on nutritional questions. The table of Recommended Daily Allowances drawn up by the Food and Nutrition Board revolutionized the concept of nutrition, Borsook later pointed out, by showing that a good diet consists not of "food" but of certain amounts of specific nutrients — proteins, vitamins, calories, and the like. After the war, Borsook joined with Clifford Clinton, philanthropist and owner of Clifton's cafeterias in Los Angeles, in the production of Multipurpose Food, a low-cost, enriched food based on soybeans, that was used to

sustain impoverished populations around the world. A non-profit organization, Meals for Millions Foundation, was set up to distribute the food. Borsook was research director and member of the board of the foundation. As of 1963, over 90 million meals had been distributed.

Borsook taught biochemistry at Caltech for 35 years. He was twice chairman of the faculty, and he also chaired the student health committee for years. Among his off-campus activities, the most memorable for old biology alumni was his sponsorship of the Anaximandrian Society, an organization that met monthly in the Borsook home on Constance Street to hear and discuss a student-written paper on some aspect of the history of biology. Interesting guests were often present, and Borsook was a brilliant conversationalist. These, along with the refreshments provided by Mrs. Borsook, made the meetings a welcome break from dormitory and rooming-house life. The society existed from 1935 to 1945. The bound papers are in the Archives.

Borsook's hobby was art history. He had a special interest in the rococo churches of Bavaria, Austria, and the Tyrol, which he photographed in annual trips to Europe. Borsook was a member of the American Society of Biological Chemists and several other professional societies. He received the Groedel Memorial Award of the American College of Cardiology in 1957.

He is survived by his wife, Lisl, and their daughter, Eve.

*Norman H. Horowitz  
professor of biology, emeritus*