Benjamin G. Levich

1917–1987

By Andreas Acrivos

Benjamin G. Levich, an internationally known physicist and electrochemist and the founder of the discipline known as physicochemical hydrodynamics, died suddenly of a heart attack on January 19, 1987, in Englewood, New Jersey. During the previous eight years, he was the Albert Einstein Professor of Science at the City College of the City University of New York as well as a distinguished professor of chemical engineering and of physics at the City College. He also held a dual appointment as a professor of physics at the University of Tel Aviv.

Ben Levich was born in Kharkov, U.S.S.R., on March 30, 1917, and received his first degree from the university in that city at the age of twenty. He then enrolled at the State Pedagogical Institute in Moscow, where he earned his D.Sc. in physics under the supervision of Academician Lev D. Landau, one of the world's outstanding theoretical physicists. His thesis dealt with a theory of the processes that occur in electrolytic cells and led him to single out the phenomenon of concentration polarization as being of singular importance and to develop, as a research tool, the rotating-disk electrode, which brought him international recognition. He then joined Academician A. N. Frumkin at the Institute for Colloid Chemistry and Electrochemistry (later renamed the Institute for Electrochemistry) of the U.S.S.R. Academy of Sciences where he continued his research until he left Russia at the end of 1978. He was head of the theoretical

department in that Institute from 1958 until 1972 and was also a full professor and department head, first of theoretical physics at the Moscow Institute of Physics and Engineering (1954–1964) and then of chemical mechanics at the University of Moscow (1964–1972).

Ben Levich was a researcher of extraordinary originality and productivity who, during his lifetime, authored more than three hundred scientific papers ranging from electrochemistry to turbulence, flows with chemical reactions, and flows dominated by variations in surface tension. He was, for example, the first to show conclusively that the seemingly paradoxical observation that the rise velocity of small air bubbles in viscous liquids equals that of solid spheres having the same density is due to the accumulation of trace amounts of surface-active agents on the gas-liquid interface. This fact has important implications in a large variety of mass transfer operations. He also showed, against all prior expectations, that certain viscosity-dominated flow phenomena, such as the attenuation of capillary waves or the steady rise velocity of moderate-sized bubbles in low viscosity liquids, can be computed simply through knowledge of the corresponding motion of fluids having zero viscosity. Other papers dealt with theories of gas-phase collision reactions, the photoemission of electrons from electrodes into solutions, and the quantum mechanics of electron transfer between ions in solution and between an ion and an electrode.

In addition, Ben Levich authored a four-volume treatise on *Theoretical Physics*, which rivals in scope the famous series by Landau and Lifshitz. Undoubtedly though, of all his publications, the one that had the biggest and most lasting impact is his book *Physicochemical Hydrodynamics* , which was first published in Russian in 1952 and then translated into English in 1962. A new field of research was thereby born at the interface between physics and chemistry, which deals with the effects of fluid motion on chemical and physicochemical transformations and conversely with the influence of the latter on the motion of fluids. This book was widely acclaimed as a masterful synthesis of different branches of science that had, until then, developed separately. Indeed, Levich showed how to create a scientific

unity out of seemingly highly diverse phenomena by lucidly expounding the relatively few underlying patterns and basic laws of science. This was achieved by using mathematical analysis to explain experimental observations and by citing the results of measurements with sufficient frequency to illustrate principles without, however, overburdening the reader with detail. Even though out of print, this book still brims with a wealth of useful information and, as befits a classic, it is very much a pleasure to read.

Ben Levich was elected a corresponding member of the U.S.S.R. Academy of Sciences in 1958, and his meteoric rise within the academic establishment of the Soviet Union as well as his research productivity would have continued unabated had he not in 1972, after long consultations with his wife, his two sons, and his conscience, applied to emigrate to Israel. All at once, his chair at the university was abolished and his status at the Electrochemistry Institute was reduced to that of a scientific worker without supervisory responsibilities. In addition, his former colleagues and collaborators, almost without exception, found reasons to distance themselves from him; Soviet journal editors declined to publish his articles; and his frequently cited name was laboriously excised from all the copies of Western publications distributed in the U.S.S.R. In fact, during this period and prior to his emigration, Levich's primary source of income was his stipend as a corresponding member of the U.S.S.R. Academy of Sciences.

Although his sons and their families were allowed to emigrate in 1975, Ben Levich and his wife, Tanya, had to stay behind on the pretext that he was in possession of state secrets. Fortunately, he was so well known and respected by his Western colleagues that the scientific establishment in the free world was quickly mobilized on his behalf. Thus, in addition to the numerous protests and letters addressed to Soviet officials, an international conference on physicochemical hydrodynamics was organized at Oxford University in 1977 and specifically dedicated to Levich, whose sixtieth birthday fell in that year. A second conference, similar in spirit, was held in Washington, D.C., the following year. Eventually, in late 1978, as a result of this continuous

agitation and following the personal intervention of Senator Edward Kennedy, Ben and Tanya were allowed to leave for Israel, where the University of Tel Aviv had, for several years, been keeping a chair ready for the most distinguished Soviet scientist ever to settle in his ethnic home.

The following year, Benjamin Levich accepted the prestigious Albert Einstein Professorship in Science at the City College of the City University of New York, where he also founded the Institute of Applied Chemical Physics, renamed the Levich Institute upon his death. In his later years, his research dealt with aspects of theoretical turbulence, but it is a measure of his universality that he felt equally at home among physicists, chemists, chemical engineers, fluid mechanicists, applied mathematicians, and biologists.

He received the Palladium Medal of the American Electrochemical Society in 1973 and was elected a foreign member of the Norwegian Academy of Sciences in 1977 and a foreign associate of the U.S. National Academy of Engineering in 1982. He was also a member of numerous scientific organizations, although on leaving the U.S.S.R. in 1978 he had to relinquish his Soviet citizenship and, therefore, was expelled from the U.S.S.R. Academy of Sciences.

Ben Levich leaves two sons, Evgeny and Alexander, and their families; his wife Tanya passed away in 1983. He was a unique scientist who left a permanent imprint and legacy in this world.