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Veniamin (Benjamin) Grigor'evich Levich (1917–1987)

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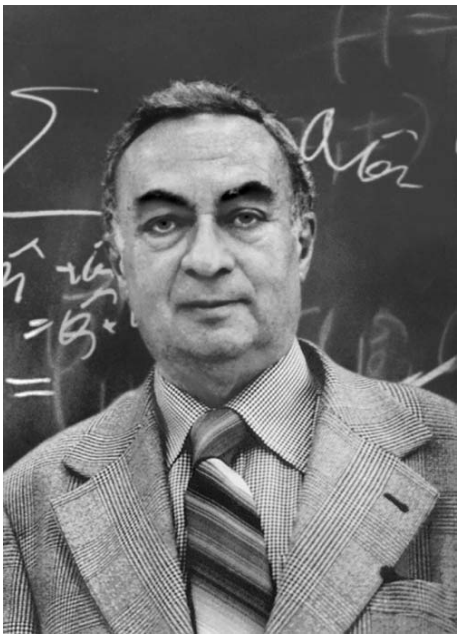

Veniamin Grigor'evich Levich was born on March 30, 1917 in Kharkov. He graduated from the Faculty of Physics of the Kharkov University being just twenty. It is at this University that he met the future academician and winner of the Nobel Prize in Physics, Lev Davidovich Landau, who at that time headed the General Physics Department. Later, Landau became his scientific supervisor. Under supervision of Landau, Veniamin Grigor'evich prepared and defended his candidate dissertation as a post-graduate student of the V.I. Lenin Moscow State Pedagogical Institute (MSPI). The dissertation was devoted to surface phenomena. Levich's name was the sixth in the famous list of physicists who had successfully passed examinations on the "theoretical minimum of Landau".

In 1940, V.G. Levich entered the Institute of Colloid Chemistry and Electrochemistry (later, Institute of Physical Chemistry of the Academy of Sciences of the USSR), which marked the beginning of his many-year contacts and collaboration with academician Aleksandr Naumovich Frumkin.

During World War II, when evacuated to Kazan, V.G. Levich worked on the problems vital for defense of the USSR. At the same time, he never stopped his theoretical studies in the field of fundamental problems of physical chemistry. His comprehensive study "*Theory of Concentration Polarization*", which contained the main concepts of his Doctorate Dissertation defended when he was 26, was published in 1942. This almost coincided in time with the publication of a paper written in cooperation with Landau, which offered a solution to the problem of withdrawal of a plate from a quiescent liquid. This paper has the highest citation index among all Levich's works and its result is known in hydrodynamics as the Landau–Levich effect.

Owing to Levich's studies, the phenomena of diffusion and concentration polarization became the most important branches of electrochemistry and gave rise to such new diverse research directions as polarographic maximums, catalytic currents on a dropping mercury electrode, nonequilibrium electric double layer. It seems that the most famous equation was derived for the electrochemical reaction current on a rotating disk electrode, which is now referred to in world literature as the Levich equation. The analytical description of the current vs. disk rotation rate dependence and the demonstration of equal accessibility of the disk surface have placed the disk electrode among the most versatile and elegant instruments of quantitative electrochemical experimentation. Of no less popularity is the rotating ring-disk electrode, a precise method for probing multistage processes, the use of which heavily relies on a theory developed in the late 50s by V.G. Levich in cooperation with Yu.B. Ivanov.

In 1952, V.G. Levich published a monograph "Physicochemical Hydrodynamics", in which he applied the methods of theoretical physics to certain problems associated with the effect of motion of fluids on the chemical and physicochemical transformations and, vice versa, the effect of physicochemical factors on the fluid motion. The physicochemical hydrodynamics had become an independent and harmonic scientific field largely due to the studies accomplished under supervision of V.G. Levich at the Department of Electrochemistry of the Institute of Physical Chemistry. These studies had received worldwide recognition after the publication of the second edition of *Physicochemical Hydrodynamics* in 1959 and its English translation (V.G. Levich, *Physicochemical Hydrodynamics*, Englewood Cliffs, New York: Prentice-Hall; 1962). This book is still topical, being a masterpiece of the synthesis of seemingly different approaches to the description of hydrodynamic and macrokinetic phenomena. There, the theoretical descriptions are alternated with the exact analysis of experimental facts, which makes this book not only a source of useful information but also an excellent example of how to scientifically describe the most intricate problems. In his analytical report of 1974, the organizer of the Scientific Citation Index Database E. Garfield offered Levich's monograph as an example of the active citing of fundamental scientific literature in applied issues.

V.G. Levich devoted much of his time to pedagogical activities. In 1940–1949, he read theoretical physics at MSPI. In 1954, Levich was given the professor title. In 1954–1964, he headed a department at the Moscow Institute of Engineering Physics (MIEP). Some of graduates from this institute joint the Theoretical Department founded by Levich at the Institute of Electrochemistry of the Academy of Sciences of the USSR. In 1966, Levich became a professor of a new department of chemical physics, which was specially organized for him at the Faculty of Mechanics and Mathematics of Moscow State University. His talent as a pedagogue was also manifested to the full degree in his several published courses of which the first was "Introduction to Statistical Physics" (1950; 2nd edition, 1954). In his memoirs, the well-known physicist A.A. Rukhadze highly esteemed this textbook as well as the courses read by Levich at the MIEP. In the beginning of 1970s, Levich published a fundamental course on theoretical physics (in co-authorship with V.A. Myamlin and Yu.A. Vdovin).

In 1958, V.G. Levich was elected to the Academy of Sciences of the USSR as a corresponding member. This coincided with the emergence of the Institute of Electrochemistry as an independent scientific center of the Academy of Sciences, on the basis of the electrochemical department at the Institute of Physical Chemistry. A.N. Frumkin initiated the development of a theoretical department under the chairmanship of V.G. Levich. Later, this department evolved into one of the most powerful theoretical groups of all chemical institutes of the Russian Academy of Sciences. This department united more than 25 scientists many of whom became the leaders in different scientific directions and still work in Russia and abroad, keeping in touch with one another on both professional and personal issues. Levich headed this department up to 1972.

Studies performed by V.G. Levich at the theoretical department of the Institute of Electrochemistry as well as his earlier works were highly original and diversified. Extending the range of topical problems of physicochemical hydrodynamics and diffusion kinetics, he formulated a theory of nonequilibrium double layer and a concept of the stage of slow reactant penetration into the electric double layer for a reactant and an electrode surface bearing charges of the same sign. Even in early stages of the Fuel Cell Program, the theoretical department headed by Levich developed the studies on macrokinetics of processes in porous media (Yu.A. Chizmadzhev, Yu.G. Chirkov, and V.S. Markin). Together with L.M. Pis'men and A.M. Brodskii, V.G. Levich devoted much attention to the theory of chemical reactors; in cooperation with Yu.I. Yalamov, he developed a theory of polyelectrolytes.

Being a theoretic physicist with a wide scope of interests, V.G. Levich understood all the importance of the development of the quantum mechanical theory of elementary act of the electron and proton transfer in polar media, which was started by R.R. Dogonadze, and actively supported these studies for many years. Based on the pioneering studies on this subject carried out in his department, V.G. Levich wrote a review still widely cited in this field. The studies by R.R. Dogonadze, Yu.A. Chizmadzhev, A.M. Kuznetsov, Yu.I. Kharkats, E.D. German, and M.A. Vorotyntsev formed the general kinetic theory of the elementary act of charge transfer in different processes; now, this direction is conventionally associated with the Russian theoretical school in the field of electrochemistry.

V.G. Levich took active part in the studies carried out at the theoretical department of Institute of Electrochemistry on the adsorption and the structure of charged interfaces, which were closely related to the kinetics of electrode processes. This direction was explored by V.A. Kir'yanov, V.S. Krylov, and, later, by A.A. Kornyshev and M.A. Vorotyntsev. In addition to the theory of reactions in solutions, a theory of gas phase reactions was elaborated (A.M. Brodskii and V.G. Levich). V.G. Levich actively backed the bioelectrochemical direction (Yu.A. Chizmadzhev, V.S. Markin, and L.I. Boguslavskii). Under Levich's supervision, A.M. Brodskii and Yu.Ya. Gurevich worked out a theory of electron photoemission in electrolyte solutions, which later gave rise to a new direction, the electrodynamics of charged interfaces, elaborated by A.M. Brodskii, M.I. Urbach, and L.I. Daikhin.

The 50th jubilee of V.G. Levich was celebrated by a magnificent amateur performance given in the Scientific Council Meeting Hall of the Institute of Physical Chemistry.

The life of V.G. Levich abruptly changed in 1972 when he voiced his decision to emigrate for Israel and applied to the corresponding office for permission. His official status was no longer the same and nor was the attitude of some colleagues to him. According to the official practice of that time, the procedure of obtaining permission to leave the USSR extremely complicated the further scientific work of the applicant. The permission was given only six years later, and V.G. Levich together with his wife Tat'yana Solomonovna followed their sons Aleksandr and Evgenii to Israel. At the Tel-Aviv University, Levich took a position of the head of a department that had waited for him for several years. In Israel, he received invitations for professorship from several universities of Great Britain, the USA, and many other countries. In March 1979, he took the position of the Albert Einstein Professor of Science at the City College of New York. It was there that he founded the Institute of Applied Chemical Physics. The studies of this institute (see http: www.geocities.com/bioelectrochemistry/levich.htm) carried out under supervision of V.G. Levich were focused on problems of fluid mechanics, heat and mass transfer, and chemical reactions and likewise on the turbulence theory.

V.G. Levich was decorated with many awards including the Palladium Medal of the Electrochemical Society (1973), which was handed to him only in 1980 at Bell Labs. He was elected foreign member of the Norwegian Academy of Sciences (1977) and the US National Academy of Engineering (1982). To his last days, V.G. Levich was the Editor-in-Chief of the journal *Physicochemical Hydrodynamics* he founded.

Veniamin Grigor'evich Levich died on January 19, 1987 in Englewood, New Jersey, USA.

After his death, the institute he founded received the name *Benjamine Levich Institute for Physico-Chemical Hydrodynamics*.

When compiling the list of publications by Veniamin Grigor'evich, we were perplexed. In library files, monographs, and reviews, the absurd "ban to mention Levich" practiced in the USSR was still to be felt, which had a negative effect on the completeness of information on his studies offered by different international databases. For example, a list published in 1977 to his 60th birthday in a special issue of the *Journal of Electroanalytical Chemistry* (vol. 82, no. 1–2) was also far from complete, particularly, it lacked the famous study carried out in cooperation with L.D. Landau. The mentioned issue published 30 years ago is still striking due to the brilliant names of its authors. Many leading foreign scientists expressed their deep respect for V.G. Levich who indeed needed their support in 1977.

The supplemented list of publications presented below is also probably incomplete but nonetheless impressive.

A. M. Kuznetsov, O. A. Petrii, and G. A. Tsirlina

LIST OF PUBLICATIONS BY V.G. LEVICH (PRESUMABLY INCOMPLETE)

Books

1. Levich, V.G., *K teorii poverkhnostnykh yavlenii* (On the Theory of Surface Phenomena), Moscow: Sovetskaya Nauka, 1941.
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