

Mikhail Vladimirovich Vol'kenshteĭn (on his 70th birthday)

B. K. Vainshteĭn, I. M. Lifshitz, A. B. Migdal, O. B. Ptitsyn, and D. S. Chernavskii

Usp. Fiz. Nauk **138**, 349–350 (October 1982)

PACS numbers: 01.60. + q

The eminent Soviet physicist and biophysicist, Corresponding Member of the USSR Academy of Sciences, Mikhail Vladimirovich Vol'kenshteĭn celebrated his 70th birthday on October 23rd, 1982.

In almost half a century of scientific work, Mikhail Vladimirovich Vol'kenshteĭn has been concerned with molecular spectroscopy, the physics of polymers, the physics of biopolymers and, finally, biophysics. He has been responsible for major advances in all these fields. His scientific interests have covered an enormous range and he has always been in the forefront of efforts to introduce physical methods of thinking and to exploit rigorous physical methods, first in relation to ordinary molecules, then macromolecules, then molecules of biopolymers (proteins and nucleic acids) and, finally, more complicated biological systems. The scientific style of Mikhail Vladimirovich is characterized by his ability to find simple and clear physical approximations that go to the heart of any new problem and are capable of providing a relatively rapid solution.

M. V. Vol'kenshteĭn was born in St. Petersburg in 1912 in the family of a well-known playwright and connoisseur of art, V. M. Vol'kenshetin, who soon after moved to Moscow. In 1930 Mikhail Vladimirovich entered the Physics Department of Moscow University and even before graduation (from 1933 onwards) began work at the L. Ya. Karpov Physico-chemical Institute. This marked the first ("spectroscopic") period of M. V. Vol'kenshteĭn's scientific work which subsequently continued at the State Optical Institute. His major achievement during this period was the development of the theory of the intensities of vibrational spectra of molecules. This theory was founded on a simple but convincing physical model, the so-called "optical-valence scheme", according to which changes in the dipole moment and polarizability of a molecule in the course of its vibrations can be represented as the sum of the corresponding characteristics of its valence bonds. Once the necessary parameters of a few "basic" molecules have been determined from experimental data, this procedure can be used to calculate the intensities in the vibrational spectra of other molecules involving the same bonds. An account of this theory of vibrational spectra was given, together with the theory of the spectral frequencies, in the well-known monograph "The Vibrations of Molecules" (1949) written by M. V. Vol'kenshteĭn, M. A. El'yashevich, and B. I. Stepanov. This monograph was awarded the USSR State Prize in 1950.



MIKHAIL VLADIMIROVICH
VOL'KENSHEĬN

In 1948 M. V. Vol'kenshteĭn joined the Institute of High-molecular Compounds of the USSR Academy of Sciences which had just been created. The center of gravity of his scientific work was thus shifted to the physics of polymers. He very rapidly put forward an unusually daring idea, namely, that of establishing the quantitative relationship between the chemical structure of polymer chains and their basic physical characteristics (in the first instance, their flexibility). At the same time he proposed a simple key to the solution of this problem, namely, the idea of the rotationally-isomeric mechanism of the flexibility of polymer chains which meant that macromolecules could be looked upon as cooperative linear systems with a discrete set of states. As a result he was able, together with his research students, to develop a systematic and rigorous theory of the flexibility of macromolecules, which was the first occasion in molecular physics when physical properties of a complex system were quantitatively calculated from its chemical structure. The summary of this work was given in his monograph "Configurational Statistics of Polymer Chains" (1959) which has retained its importance to this day.

Since the early 1960's, M. V. Vol'kenshtein's scientific interests have increasingly shifted toward a new and rapidly developing subject, namely, that of molecular biology and molecular biophysics. For these reasons, in 1967, he became Head of the Laboratory of Biopolymer Physics of the Institute of Molecular Biology of the USSR Academy of Sciences (Moscow) and the Division of the Physics of Biomolecular Structures of the Institute of Biophysics of the USSR Academy of Sciences (Pushchino) where he was responsible for the extensive development of research into molecular biophysics. Here again he introduced a number of ideas shedding new light on important branches of this science. For example, he put forward the hypothesis that the reduction in the barrier for chemical reactions, which was connected with the interaction between electronic and conformational (i.e. nuclear) degrees of freedom, plays an important role in biological catalysis. He was the first to discover well-defined regularities in the genetic code, which ensure the preferential replacement of polar aminoacid residues by polar residues, and the replacement of non-polar by non-polar residues in the course of viable point mutations. This led him to the important conclusion that the majority of mutations may not modify the basic features of the structure of a protein. He subsequently introduced the idea of the relative value of codons, which led him to the formulation of the more general concept of the importance of biological information and to the first attempts at quantitative estimates of its value.

The breadth of scientific interests of M. V. Vol'kenshtein is characterized in particular by the fact that although he is essentially a theoretical physicist he has nevertheless constantly initiated the development of new methods for the experimental investigation of the various objects of interest to him. Polarized luminescence of macromolecules and the optical rotation and circular dichroism of proteins in a magnetic field ("The Faraday Effect") which, as a result of his work and that of his collaborators, have become powerful research techniques, occupy a special place among the new methods developed under his direction.

Mikhail Vladimirovich is a born teacher, who generously shares with his pupils his many ideas without

restricting their own work. He rejoices in the successes of his research students just as he does in his own, and this quality and the true democratic spirit of this major scientist have always favored the establishment of an atmosphere of exceptional good will among the staff headed by him, which has greatly contributed to the success of their scientific work. Since 1945 he has given lectures to students in his role as Professor of the Leningrad University (1945-1953 and 1963-1967) and the Moscow Physicotechnical Institute (since 1968). Sixty Candidate and twelve Doctoral theses have been produced under his direction. In addition to the two monographs mentioned above, and based largely on his own research, he is the author of a further seven monographs that have been used by generations of students and researchers in molecular physics and biophysics. He is the author of four popular science books, written with his customary luster and fluency of exposition.

The benign character of Mikhail Vladimirovich and the great range of his scientific interests are not in any way indications of indifference. He is an active and implacable foe of any kind of inflated "scientific" sensation or pseudoscience, however presented or advertized. At the same time, he is always ready with his support for genuinely new developments in science, irrespective of whether or not they have received general acceptance.

The many-sided talents of Mikhail Vladimirovich are not confined to science. He is a highly educated man, with great knowledge and appreciation of literature and art. He has written humorous sketches as well as science fiction, he paints in oils and water colors, and his house is one of those places where scientists and arts people meet on equal terms, both usefully and pleasurably.

We greet Mikhail Vladimirovich on this his seventieth birthday and wish him good health, further success in his work in science, and many years of happiness and achievement among his students, coworkers, and friends.

Translated by S. Chomet