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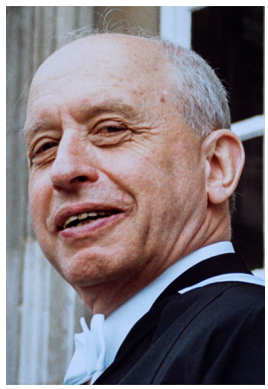
OBITUARY

In Memoriam



Grigory Isaakovich Barenblatt
July 10, 1927–June 22, 2018

Grigory Isaakovich Barenblatt was born in Moscow, USSR on July 10, 1927, in a family of scientists in the field of medicine. His mother, the virologist Nadezhda Veniaminovna Kagan, developed a vaccine against viral encephalitis and died tragically from contracting this dangerous disease. His father was a well-known Moscovite endocrinologist, Isaak Grigorievich Barenblatt, co-author of the repeatedly republished two-volume *Therapeutic Directory*. His maternal grandfather, a well-known mathematician Veniamin Fedorovich Kagan, instilled in him a love for mathematics from childhood. Younger brother of G.I. Barenblatt on the maternal line, Yakov Grigor'evich Sinai is an outstanding mathematician and winner of many prestigious awards, including the Abel Prize (2014).

Grigory I. Barenblatt graduated from Lomonosov Moscow State University (MGU), Faculty of Mechanics and Mathematics in 1950. From 1950 to 1953, he was a postgraduate student of MGU, Faculty of Mechanics and Mathematics. G.I. Barenblatt successfully defended his Ph.D. thesis (MGU) in 1953, under the guidance of A.N. Kolmogorov, and his D.Sc. thesis in 1957 (MGU). In 1962, he became a Professor at MGU.

From 1953 to 1961 G.I. Barenblatt worked at the Institute of Petroleum, USSR Academy of Sciences. From 1961 to 1975, he held the position of the Head of the Plasticity Department of the Institute of Mechanics at MGU. He took part in the creation, and was the deputy director of, the Institute of Problems in Mechanics of the USSR Academy of Sciences (1965). From 1975 to 1992, G.I. Barenblatt held the position of the Head of the Theoretical Department at the Institute of Oceanology of the USSR Academy of Sciences.

After the collapse of the USSR, G.I. Barenblatt worked abroad. He was appointed as the G.I. Taylor Professor of Fluid Mechanics at the University of Cambridge in the U.K. (1992–1994). When he retired from that position, he went to the United States, held a few short-term visiting positions, and then joined the Mathematics Department at the University of California, Berkeley, as a Professor in residence, with a concurrent appointment at the Lawrence Berkeley Laboratory.

Since 1990, he was a visiting professor at a number of universities in the USA, Great Britain, Spain, Italy, and France. He participated in the publication of many

international scientific journals. In 2012, G.I. Barenblatt returned to the Institute of Oceanology of the Russian Academy of Sciences as a Principal Researcher.

G.I. Barenblatt is one of the few scientists who made a significant contribution to almost all branches of continuum mechanics. Being a universal scientist, he also contributed to the solutions of a number of problems in the theory of polymers, biology, chemistry and geophysics. His results in the fields of fracture mechanics, hydraulic fracturing, filtration of fluid and gas in a porous medium, mechanics of non-classical deformable solids, turbulence, self-similarities, nonlinear waves, and intermediate asymptotics are well known.

The versatility of G.I. Barenblatt's talent was already manifested in the fact that after defending his Ph.D. thesis, "On the motion of suspended particles in a turbulent flow" (1953), he switched to a new area of study—the theory of fluid and gas motion in porous media. The leader of this school of study in the USSR was P.Ya. Polubarinova-Kochina, Barenblatt's mother-in-law. Already in 1957, G.I. Barenblatt defended his Doctor of Science dissertation, "Some problems of the hydrodynamic theory of nonstationary filtration." Its results contributed not only to underground hydrodynamics, but also to the theory of degenerate partial differential equations, whose origin dates back to the middle of the nineteenth century. Equations of the type of nonlinear thermal conductivity or diffusion arise in problems of gas filtration in a porous medium. In contrast to the classical heat equation, they are characterized by a finite propagation velocity of the perturbations along the zero background. Based on the simple model, G.I. Barenblatt discovered the "waiting time" phenomenon: the front movement in some cases does not begin immediately but after some time of induction. In the same dissertation, the famous self-similar solution with a spherical front was presented, which describes the leading term of the asymptotics of the solution of the Cauchy problem with finite initial data over a large time interval.

G.I. Barenblatt repeatedly returned to the problems of filtration. He generalized the postulates of the classical theory of filtration to the case of liquids with complex rheology, such as oil and drilling fluids. He also published works on fluid filtration in fractured rocks. The processes occurring in the cracks and in the pore space have significantly different temporal and spatial scales. For their description, an original model based on the concepts of "two-velocity" hydrodynamics was proposed.

The achievements of G.I. Barenblatt in the field of fracture mechanics can be summarized as follows: development of a fundamental mathematical model of elastic body with cracks based on explicit introduction of cohesion forces and solutions of basic problems; introduction of one of the basic characteristics of fracture toughness—cohesion modulus; development of a basic model of the kinetics of crack propagation; applications to fracture problems of metals, rocks, and polymers; development of similarity laws for fatigue cracks and multiple fracturing; modeling of small fatigue cracks; development of a mathematical model of nonlocal damage accumulation; and development of mathematical models of self-oscillation, analysis of self-similar phenomena in fatigue fracture.

The research of G.I. Barenblatt in the field of materials science, carried out almost 40 years ago, remains relevant and attracts the attention of many specialists to this day. Perhaps the reason for its success lies in the fact that it touched upon some fundamental questions on the development of multiple destruction at different scale levels and under various loading conditions, which allows us to view these processes from the common positions of self-similarity.

For his outstanding achievements, G.I. Barenblatt received numerous awards, among them the G.I. Taylor award from the Society for Engineering Science, the Maxwell prize of the International Committee on Applied and Industrial Mathematics, the Lagrange Prize of the Accademia Nazionaledei Lincei, Modesto Panetti Prize and Medal, and the Timoshenko Medal of the ASME. G.I. Barenblatt was elected as a foreign honorary member of the U.S. National Academy of Sciences, the U.S. National Academy of Engineering, the American Academy of Arts and Sciences, and the Royal Society of London, as well as a long list of other professional societies in other countries.

G.I. Barenblatt published a number of well-known monographs (listed below) and about 250 papers. He was an esteemed lecturer and had a substantial impact on his colleagues and students. Many of his students became well-known scientists themselves. The legacy of Grigory Isaakovich Barenblatt in the development of continuum mechanics endures, and his contributions to the field will be lauded and revered for years to come.

The Russian National Committee on Theoretical and Applied Mechanics

List of Books Published by G.I Barenblatt

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