

Academician Zamaraev 1939–1996. A tribute



Kirill Illyich Zamaraev, a former President of the International Union of Pure and Applied Chemistry, IUPAC (1993–95), holder of the Centenary Medal of the Royal Society of Chemistry (1995) and former Director of the Boreskov Institute of Catalysis of the Siberian Branch of the Russian Academy of Sciences, died in the prime of his brilliant scientific career. News of his passing cast gloom over the twelve hundred delegates in the 11th International Congress on Catalysis, from 1 to 7 July, at Baltimore, where he was scheduled to deliver one of the plenary lectures on “Photocatalysis: state of the art and perspectives”.

Kirill Zamaraev was an extraordinary individual. Equally adept as a theoretician and experimentalist, he was an exceptionally versatile chemical physicist, who communicated the gifts and insights of his teachers in Moscow (among them Lev. Landau and Piotr Kapitza) to a large family of chemists and engineers. Widely read in several languages he had a finely developed taste for literature, the theatre and ballet; he was a born leader and an astute diplomat who instilled confidence into others and inspired great efforts from his colleagues. He

was a life-enhancing soul, whose company and friendship was valued by all who met him. During the upheavals and changes consequent upon the disintegration of the Soviet Union Zamaraev played a leading role in the transformation of Russian science and its adoption of the market force economy. In particular, he assisted in the establishment of a network of Federal Research Centres throughout Russia. All this occurred when he held office as President of IUPAC, which itself demanded an extensive and punishing round of worldwide visits to international conferences and workshops, as well as constant liaison with the IUPAC secretariat in England, at Oxford.

Kirill Zamaraev was born in Moscow in 1939, the son of an eminent Soviet chemical engineer. His early interest in science prompted his father to give him a copy of a book on the life and work of Michael Faraday, who became one of his scientific idols. As a teenager he pursued most of his secondary education in Moscow through the medium of English. Later he entered the Mendeleev Institute of Chemical Technology and then the Moscow Physical Technical Institute so as to

enhance his already formidable skills as a chemical physicist. In both these universities he was the star student.

For the Soviet equivalent of his PhD (awarded in 1972), he studied initially under Academician Vojevodski (who also died prematurely) at the N.N. Semenov Institute of Chemical Physics in Moscow. His early researches were in the applications of electron spin resonance – a technique invented in the Soviet Union by Zavoisky in the early 1940s – to chemical problems and in the theory and phenomenology of the tunneling of electrons over large distances. His skills and excellence were such that, in a mere fourteen years, he moved through the ranks from junior to senior scientist (and to head one of the laboratories of the prestigious Institute of Chemical Physics of the Soviet Academy) and was elected a Corresponding Member of the Academy – one of the youngest in the Union – in 1976.

It was in the early 1970s, while sitting with his parents in their apartment in Moscow, that he received a phone call at about 10.30 one night that was to change the course of his career. “This is Nikolai Nikolaievich speaking”, said the distinguished voice at the end of the line. Thinking that it was one of his friends playing a prank, Zamaraev answered in cavalier fashion. But the voice was indeed that of N.N. Semenov, joint winner (with Sir Cyril Hinshelwood) of the 1956 Nobel Prize for Chemistry.

What Semenov required were some rather rudimentary lessons in quantum mechanics, and he had been told by his colleagues that young Zamaraev was the most compelling of teachers. Zamaraev told his parents that night that he would be working through his textbooks and papers until early morning, for he had promised to give the great Semenov some tutorials the following day. Semenov was at that time in a pivotal position in the Soviet scientific effort on the harnessing of solar energy. This was Zamaraev’s introduction to photocatalysis, photophysics and photoelectrochemistry, subjects upon which he later became a world authority.

In 1974–1975, as part of a US–USSR exchange programme, Zamaraev held a series of visiting professorships at the Universities of Cornell, Stanford and Chicago, where his superb fluency in English and the authoritative flair of his scientific understanding were to impress his American hosts. In 1977 he was selected as the heir apparent to Academician Borekov as Head of the largest institute of catalysis in the world (employing over a thousand people), set up as part of the Khrushchev experiment, in Akademgorod, Novosibirsk, in Siberia. He took a large team of bright Muscovite chemical physicists with him, thereby broadening the horizons of the already formidable “Borekov” Institute so as to encompass fundamental and applied studies ranging from ab initio quantum mechanics to enzymatic chemistry. In 1984 he took over

as Director, a post that he held until 1992, when he decided to relinquish some of his administrative duties in favour of the more active pursuit of research. By 1987 he had become a full member of the Academy of Sciences of the Soviet Union, and was in great demand world-wide as a plenary speaker on a host of topics ranging from industrial applications, chemical engineering practices and laboratory “model” studies of catalysis.

When the Royal Society introduced its Kapitza Fellowship Scheme shortly after the collapse of the Soviet Union, Zamaraev was one of the first to be appointed (for six weeks based in the Davy Faraday Laboratories of the Royal Institution, but with visits to the Universities of Cambridge and Wales at Cardiff). His group at Novosibirsk had started a collaboration, which continued up to the time of his death, with mine at the Royal Institution in 1988, on the catalytic properties of zeolites. Our prime aim was to understand how the catalytic breakdown of certain molecules is influenced by confinement within the pores and cavities of zeolitic solid.

Zamaraev’s memorable Centenary Lecture, given in the theatre of the Royal Institution, London, on 25 January 1995, still rings in one’s ears. In it he described, inter alia, how, at the Borekov Institute they had (i) sweetened natural gas (i.e. succeeded in eliminating the hydrogen sulphide from methane); (ii) harnessed the sun’s rays to remove the same gas photocatalytically from naturally contaminated inland seas in Russia; (iii) utilised immobilised enzymatic catalysts to convert natural gas to methyl alcohol; (iv) designed a catalyst to convert methyl alcohol to formaldehyde; (v) devised a means of converting wasteful sulphurous by-products from industrial plants into sulphuric acid; and (vi) set up in Ukraine a thermocatalytic converter which stores solar energy chemically and releases it by ingenious use of catalysts. All this and more is described in one of his last major articles (published May 1996, in *Topics in Catalysis*, Vol. 3, pp. 1–77). While in a Moscow hospital in the autumn of 1994 he wrote a beautiful booklet that chronicles the achievements of Russian scientists in catalysis from the days of Lomonosov (1711–1765) onwards. It contains a wealth of evocative entries, including the fact that Borodin described the so-called aldol condensation ($2\text{CH}_3\text{CHO} \rightarrow \text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CHO}$) in 1872.

When Kirill Zamaraev visited Cambridge in the summer of 1993 with his wife Mila he quoted his beloved Pushkin:

How many and marvellous are the discoveries prepared for us by the spirit of enlightenment, by experiment, the child of error and effort, by genius, the friend of paradox, and by that divine inventor, Chance.

It was as a result of chance that he and I met, at the 8th Congress on Catalysis in Berlin, July 1984.