

CSABA HORVÁTH

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CSABA HORVÁTH

1930-2004

Elected in 2004

“For pioneering the concept and the reduction to practice of high-pressure liquid chromatography and for leadership in the development of bioanalytical techniques.”

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CSABA HORVÁTH, the Roberto C. Goizueta Professor of Chemical Engineering at Yale University and a pioneer of high performance liquid chromatography (HPLC), passed away on April 13, 2004, at Yale New Haven Hospital following a stroke. He was 74. He was elected to the National Academy of Engineering in early 2004, a recognition that deeply moved him and served as a fitting capstone to a lifetime of contributions, though it came just months before his death. Widely acknowledged for coining the now ubiquitous term HPLC (originally called high-pressure liquid chromatography), Csaba's groundbreaking work revolutionized analytical biochemistry and shaped modern separation science, creating a multibillion-dollar industry that continues to enable discoveries across medicine, biology, and chemistry.

Csaba was born on Jan. 25, 1930, in Szolnok, Hungary. He earned a degree in chemical engineering from the Technical University of Budapest in 1952 and remained there as a researcher. During the Hungarian Revolution in October 1956, he participated in student demonstrations and distributed anti-Soviet leaflets. After Soviet forces crushed the uprising, he fled to West Germany, where he worked at Farbwerke Hoechst AG, first in a pilot plant and later on surface chemistry of organic pigments.

In 1961, Csaba began doctoral studies at J.W. Goethe University in Frankfurt under István Halász, earning a Ph.D. in physical chemistry in 1963. His research led to the invention of support-coated open tubular columns for gas-liquid chromatography. That same year, he married Valeria Scioscioli in Rome, and the couple emigrated to the United States. As a postdoctoral fellow at Harvard Medical School, his work analyzing cholesterol irradiation products made him acutely aware of the severe limitations of existing liquid chromatography techniques.¹

In 1964, Csaba joined Yale University's School of Medicine, where he worked with S. R. Lipsky to develop analytical methods for detecting organic substances in rock samples that would later be brought back from the moon. This led him to design and build the first high-pressure liquid chromatography instrument; the term "high performance" would be adopted later. He subsequently focused on demonstrating the feasibility and transformative potential of HPLC for bioseparation sciences. Beginning in 1967, he also held an appointment in Yale's Faculty of

¹ Ettre LS. 2005. Csaba Horváth and the development of the first modern high performance liquid chromatograph. *LC/GC North America* 23(5):486-95.

Engineering. He joined the Department of Chemical Engineering in 1972, was promoted to full professor in 1979, and served as department chair from 1987 to 1993. During that period, he was named the Llewellyn West Jones Professor of Chemical Engineering, and in 1998, was appointed the Roberto C. Goizueta Professor, a position he held until his death.

Csaba's contributions to separation science were profound and wide-ranging. He pioneered reversed-phase HPLC – now the most widely used chromatographic method – and demonstrated the utility of displacement chromatography for preparative HPLC. Together with Imre Molnár and Wayne Melander, he developed the solvophobic theory of reversed-phase liquid chromatography. Their landmark 1976 paper has been cited more than 1,600 times.² He also characterized the principles of hydrophobic interaction chromatography for protein separations and established key theoretical foundations for ion-pair chromatography.

An early advocate of elevated temperature separations, Csaba demonstrated that combining small particle technology with increased temperature enabled protein separations to be completed in seconds. His development of microbore HPLC columns using 2-micrometer microspheres pushed the limits of protein analysis. Throughout his career, he remained at the forefront of emerging separation technologies, making fundamental contributions to capillary electrochromatography. His work in this area spanned theory, instrumentation, and column technology, and he recognized early that capillary

² Horváth C, Melander W, Molnár I. 1976. Solvophobic interactions in liquid-chromatography with nonpolar stationary phases. *Journal of Chromatography A* 125(1):129-56.

electrochromatography represented more than a simple hybrid of capillary electrophoresis and HPLC.^{3,4}

Over the course of his career, Csaba authored approximately 300 publications, held nine patents, and supervised more than 100 graduate students and postdoctoral fellows. He mentored his students not just scientifically but personally, often continuing to advise and support them long after they left his laboratory. He served on the editorial boards of numerous scientific journals, on review panels for the National Institutes of Health and the National Science Foundation, and as a consultant to pharmaceutical and biotechnology companies, including Astra Draco in Lund, Sweden, and Genentech, effectively bridging fundamental research with industrial application.

Csaba received numerous professional honors, including the Dal Nogare Award (1978); the Commemorative Chromatography Medal and M. S. Tswett Chromatography Medal from the USSR Academy of Sciences (1978, 1980); the Humboldt Award for Senior American Scientists (1982); the Chromatography Awards of the American Chemical Society (1983); the Eastern Analytical Symposium (1986); the Martin Medal from The Chromatographic Society (1994); the Halász Medal Award (1997); the American Chemical Society's National Award in Separation Science and Technology (2001); the Cross of Honor for Arts and Sciences of the Austrian Republic (2002); and the Torbern Bergman Medal of the Swedish Chemical

³ Greibrokk T. 2004. The contributions of Csaba Horváth to liquid chromatography. *Journal of Separation Science* 27(15-16):1249-54.

⁴ Svec F. 2004. Csaba Horváth's contribution to the theory and practice of capillary electrochromatography. *Journal of Separation Science* 27(15-16):1255-72.

Society (2003). He also received an honorary doctorate from the Technical University of Budapest in 1986, became an external member of the Hungarian Academy of Sciences in 1990, and was named a founding fellow of the American Institute for Medical and Biological Engineers in 1992.

Those who knew Csaba remember him as far more than a brilliant scientist. He possessed a remarkable ability to engage others in stimulating discussions that extended beyond science to encompass cooking, art, philosophy, and music – he played piano and performed in a band as a teenager. He had a particular interest in language and coined numerous terms in chromatography, some of which, including “isocratic” and “multimodal,” became so widely used that their origins are now largely forgotten. He also delighted colleagues with “the four ailments of analytical biologists” – lithophobia, siderophobia, barophobia, and adiaphanophobia: the fear of silica, steel, pressure, and nontransparent devices.⁵

Known for his old-fashioned courtesy and genuine interest in people, Csaba often drew students into stimulating discussions late into the evenings and on weekends. Barbecues at his home and gatherings marking the arrival and departure of students and collaborators provided occasions to discuss science in relaxed, informal settings.

Csaba’s collaborative spirit fostered an international community of scientists across academia and industry in Europe, Asia, and the Americas, advancing separation science through shared knowledge. His former students, who call themselves “Csabaite,” formed an international network that remains active today. On his 70th birthday in 2000, they organized the Horváth

⁵ Guiochon G, Beaver LA. 2004. People: Csaba Horváth (1930-2004). *Analytical Chemistry* 76(11):195 A.

Symposium at Yale, where all presentations were delivered by Csabaites. Csaba maintained extraordinarily high standards for his own work and naturally extended those expectations to those around him, challenging students not only to describe their research but also to articulate the hypotheses that motivated it. His insistence on rigorous thinking, paired with his ever-present warmth and humor, made him an unforgettable mentor who inspired both scientific excellence and personal growth.

The Csaba Horváth Young Scientist Award, established for the best presentation by a scientist under age 35 at the HPLC International Symposia, continues to encourage emerging researchers. The Horváth Csaba Memorial Laboratory of Bioseparation Sciences established in 2004 by András Guttman with support from a Marie Curie Chair grant from the European Commission, carries forward his legacy in Hungary, along with a permanent exhibition of his memorabilia at the University of Pannonia in Veszprem.⁶ The Csabaites network continues to meet regularly, with Imre Molnár organizing annual online gatherings on Csaba's birthday. Memorial sessions at International Symposia on Separation Sciences, including meetings in Rome in 2010 and Messina in September 2024, attest to the enduring impact of his work and influence.⁷

Csaba is survived by his former wife, Valeria Scioscioli, and his daughters, Donatella of New York City and Katalin of London.

⁶ Guttman A. 2006. HPLC 2006 and the legacy of Professor Csaba Horvath. *Journal of Separation Science* 29(17): 2698-99.

⁷ Corradini D. 2024. Celebrating Csaba Horváth's Living Legacy at ISSS2024. *The Analytical Scientist*, May 31.