



## RICHARD H. LYON

1929–2019

Elected in 1995

*“For development of statistical energy analysis and  
machinery noise diagnostic techniques.”*

BY GEORGE C. MALING JR. AND DAVID L. BOWEN

**R**ICHARD H. LYON, professor emeritus at Massachusetts Institute of Technology, president of RH Lyon Corp, and a seminal contributor to the areas of statistical energy analysis, machinery diagnostics, and product sound quality, died January 21, 2019, at the age of 89.

Dick was born to Chester C. and Gertrude B. Lyon in Evansville, Indiana, on August 24, 1929. He graduated magna cum laude from Evansville College in 1952, where he majored in physics. He initially tried to enlist in the Navy’s Electronics Technician School but failed its color vision test; instead he built audio systems, repaired radios, and worked at a local radio station throughout his college years.

He went to graduate school in the MIT Physics Department, where he received his PhD in 1955, performing thesis research on the turbulent excitation of strings under the direction of K. Uno Ingard. He then joined the electrical engineering faculty at the University of Minnesota, where he taught courses in acoustics and communication theory and conducted research in acoustics and structural vibration.

In 1959 he traveled to the University of Southampton to work on random vibration with Elfyn Richards, and that fall he began a 9-month stay at the University of Manchester under a National Science Foundation postdoctoral fellowship,

working with the statistician Maurice Bartlett. He did research on the statistical analysis of interacting vibrating systems, and it was during this time that he combined his diverse background in physics, electrical engineering, and acoustics to formulate ideas that became the basis of his development of statistical energy analysis.

Upon returning to the United States in 1960, he joined Bolt Beranek and Newman in Cambridge, Massachusetts, where he worked on problems of sound-structure interaction, excitation of structures by turbulence, and a variety of other consulting and research projects, eventually becoming director of the Physical Sciences Division and corporate vice president. He maintained his technical skills and made significant contributions to the field while managing a BBN division that grew significantly in size under his leadership.

During his 10 years at BBN he published over 35 papers, representing a major contribution to the field of acoustics, for which he was elected a fellow of the Acoustical Society of America (ASA). During his prolific career, he wrote five books, over 200 technical papers, and a large number of technical reports.

In 1970 Dick was recruited to be a full professor at MIT by Stephen Crandall, an expert in random vibration. He joined the faculty in the Mechanical Engineering Department, where he headed the Division of Mechanics and Materials in the areas of sound, vibration, and dynamics and was instrumental in the development of the MIT Acoustics and Vibration Lab.

He also founded two companies during his tenure at MIT, Cambridge Collaborative, with Jerry Manning, in 1970 and RH Lyon Corp in 1976.

Dick retired from MIT in 1995 and devoted himself full-time to RH Lyon Corp, working with clients on machinery diagnostics, audio, transducer development, quiet product design, and methods of designing for product sound quality. In 2005 the company became a part of Acentech Incorporated, a spin-off from Bolt Beranek and Newman.

The areas of Dick's research throughout his career—spanning acoustical scale modeling, statistical energy analysis

of complex structures, and signal processing, in addition to the aforementioned areas—demonstrated the great diversity of his interests and knowledge in acoustics and vibration. He once said that when he got to grad school at MIT he was struck by the number and breadth of projects in the acoustics lab, ranging from underwater sound to psychoacoustics, and that this made him aware of the richness of the field and probably encouraged him to work in such a large variety of areas over the years.

He is particularly well known for his contributions to understanding of the transmission of acoustical and vibrational energy in complex structures and to the surrounding fluid. He was a key developer of the method of statistical energy analysis, which treats vibratory energy as a form of thermal energy and takes advantage of this similarity to find simple relationships that enable prediction and interpretation of the spatial distribution of the energy in a structure and the surrounding fluid. In recent years he extended this effort to analysis of the phase of vibratory signals, called *statistical phase analysis*, which has application to machine diagnostics and signal dereverberation in telephony and other areas.

He developed new ways to analyze vibration signals from machinery to diagnose events that are not readily handled by conventional methods. These involve highly transient vibrations that occur in reciprocating machinery because of impacts and transient forces among the components. This effort has required the application of certain signal processing techniques that, while known, had not been widely used for machine diagnostics.

He also had a strong interest in sound quality as applied to products, and was an early proponent of using “juries” of actual product users who, with their experience and expectations, bring context to the process of evaluating product sounds. He adapted statistical methods used in the food and flavor industries and applied them to jury testing, where users listen to and rate variations of a product. The result is a set of mathematical relationships that can be used to guide the design of the mechanical and structural components to

achieve a better-sounding product, as judged by end users. He worked on the engineering and psychoacoustical aspects of product sound of an impressive range of products, from sewing machines to vacuum cleaners, washing machines, air tools, and air purifiers.

Elected to the NAE in 1995, Dick's interests spanned more than half of its disciplinary sections. He served on the authoring committee that produced the consensus report *Technology for a Quieter America* (National Academies Press, 2010), and chaired its Subcommittee on Research and Development of Noise Control Technology.

He was ASA president (1993–94), and a member of the executive council and editorial board for the *Journal of the Acoustical Society of America*. He was also active in the Institute of Noise Control Engineering (INCE-USA), serving on organizing committees for several NOISE-CON and INTER-NOISE meetings.

Among the honors in recognition of his contributions, in addition to the ASA he was elected a fellow of the American Association for the Advancement of Science and an honorary fellow of INCE-USA. He was awarded the Rayleigh Medal by the UK Institute of Acoustics (1995), ASA's Silver Medal in Engineering Acoustics (1998) and Gold Medal (2003), Acoustical Society of India Gold Medal (2003), and Per Brüel Gold Medal for Noise Control and Acoustics (2013) from the American Society of Mechanical Engineers.

Dick was an avid and curious reader and a man with wide-ranging interests. He enjoyed all kinds of music—country and jazz as well as opera and string quartets. After his retirement from MIT he learned the classical guitar and played often. He even managed to write a paper or two on certain aspects of the guitar that, as a “structural acoustician,” he found intriguing. He also enjoyed hiking and the outdoors. Throughout his years at MIT he rowed a single shell on the Charles River and Long Pond on Cape Cod. He loved cars, both driving them and taking them apart, and had raced and rallied in his younger days.

Dick Lyon was an enthusiastic educator and problem solver. His strong interest in and enthusiasm for acoustics inspired a

number of his graduate students to pursue careers in the field, and he supported and developed long-lasting ties with many of them, some of whom became colleagues. He and his wife Jean were often warm hosts to his international students over holidays. He encouraged the best for his family and friends through education, hard work, finding solutions to problems, and enjoying lively good times together.

Dick is survived by his wife of 53 years, Jean Wheaton Lyon; children Katherine Lyon Davis (John), Geoffrey Cleveland Lyon (Jen), and Suzanne Lyon Riggle (Jason); seven grandchildren; and three great-grandchildren.