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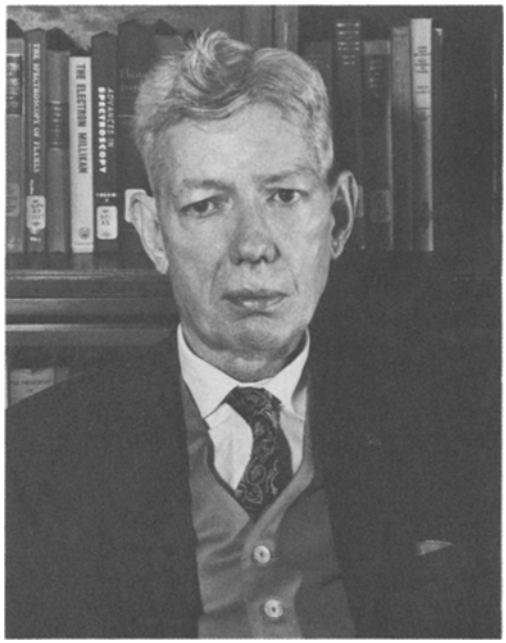
In Memoriam: Dr. Charles W. Beckett (1907–1983)



Dr. Charles W. Beckett: 1907–1983

Thermodynamicists throughout the world lost a good friend, mentor, and colleague when Charles William Beckett died on February 3, 1983, of emphysema at the age of 75.

He was born September 23, 1907, in Humble, Texas, and grew up and was educated in California. At the age of 16 he was attacked by rheumatoid arthritis. Throughout his life he suffered from it and walked with crutches. After being bedridden for many years, he attended Bakersfield Junior College, and then the University of California (Berkeley), where he received the bachelor's degree (1943) and the Ph.D. degree (1945) in

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chemistry. He held an Allied Chemical and Dye Fellowship and a Shell Fellowship as a graduate student. His doctoral dissertation, done under the direction of Henry Frank, was on the interpretation of activity coefficients of strong electrolytes in terms of solvation effects. From 1945 to 1947 he was a research associate of the American Petroleum Institute Project 44 at Berkeley, where he published analyses of molecular spectra and applied them to the computation of thermal functions. After three years at the Cryogenics Laboratory at Ohio State University, he joined the staff of the National Bureau of Standards, where he remained until his retirement in 1976. In 1950 Charles Beckett married Helen Jaeger, who died in 1972. They are survived by four children, Helena, Michael, Patricia, and Charlotte.

From 1953 to 1959 he served as chief of the NBS Thermodynamics Section and then as assistant chief of the Heat Division until 1969. From 1970 to 1976 he was senior scientist and consultant in the Physical Chemistry Division. From 1962 to 1975 he was editor of the *Journal of Research of the National Bureau of Standards*.

As chief of the Thermodynamics Section in the 1950s, Charles Beckett initiated and nurtured a wide range of experimental and theoretical research programs. He built up widely recognized groups in statistical mechanics, molecular spectroscopy, and high pressure to supplement the experimental thermodynamics. These groups generated a high level of basic-science output, yet they were effectively coupled into the applied programs that developed in the late 50s and early 60s. To give an example, the first systematic use of modern digital computers for the determination of molecular force fields from infrared and Raman spectra was carried out at that time in his section. Similarly, the calculation of ideal gas thermal functions for water was an early scientific use of SEAC (Standards Eastern Automatic Computer).

Charles Beckett showed remarkable vision in anticipating the way in which new scientific tools could be applied to long-term problems. One of his major achievements was establishing experimental programs in high temperature thermodynamics, which were required initially for rocket propulsion and later for other high temperature technologies. In this work two themes stand out: (1) the determination of the species present and their molecular parameters, and (2) the measurement of thermodynamic properties of the bulk material. Among the experimental techniques developed under this program were infrared spectra of matrix-isolated high-temperature vapors, high-temperature equilibrium mass spectrometry, exploding wires as a source of molecular species, microwave spectroscopy of high temperature vapors, equilibrium studies using shock tube techniques, high-speed techniques for thermophysical measurements, fluorine bomb and

flame calorimetry, high-temperature drop, and receiving calorimetry and transpiration techniques.

Major NBS experimental facilities in receiving calorimetry and high-speed thermophysical measurements were a result of these studies. The latter facility permits accurate simultaneous measurement, in less than a second, of heat capacity, electrical resistivity, thermal emissivity, thermal expansion, and phase transitions in metals, over the range 1500–4000 K.

The theoretical studies led to the statistical mechanical calculation of equations of state for a wide variety of high-temperature species. An example is the use of cluster theory to calculate the thermodynamic properties of a molecular gas at a temperature at which dissociation is important. Other applications of theory are the much cited NBS Circular 564 "Tables of Thermal Properties of Gases," and NBS Monograph 20 on functions for the isotopes of hydrogen, for both of which Charles Beckett was a coauthor.

Recognizing the importance of data in applied design, he included the compilation of thermodynamic data in his programs, and helped found the JANAF Thermochemical Tables. For two decades he was an active member of the group that guided the JANAF experimental and data programs. In the early 1960s, he helped plan for the National Standard Reference Data System and throughout his career was an enthusiastic booster of critical evaluation of data.

Dr. Beckett was active in the International Union of Pure and Applied Chemistry, and both organized and served as the first Chairman of the Physical Chemistry Division's Subcommittee on Plasma Chemistry. His scientific interests extended beyond thermodynamics. They included accurate radiation thermometry, lattice-dynamics calculations, structure-function correlations for polynuclear organic carcinogens, energy supply, and exobiology.

In 1957 he received (with L. Haar) the Ludwig Mond Prize of the Institution of Mechanical Engineers, London, for the best paper presented at its conference on Thermodynamics and Transport Properties of Fluids; and, in 1967, he was awarded both the Department of Commerce Gold Medal Award and the Huffman Award of the Calorimetry Conference for his leadership in thermodynamics research. He was a member of Phi Beta Kappa and Sigma Xi, a Fellow of the American Physical Society and a member of the American Chemical Society. A symposium entitled "Vistas in Chemical Thermodynamics" was held in his honor upon his retirement in 1976.

His scientific achievements were great. The results of his efforts both as a scientist and a leader are of enduring quality. Despite his physical disabilities, of which he never complained, he traveled widely and had a

great impact on the direction of chemical thermodynamics. As an active member of the international scientific community, he was an ambassador of good will. As a systems analyst he was superb. He possessed the rare ability to perceive the apparent needs of applied technology and to then formulate programs in basic science that would provide the data necessary to the realization of the technology's goals. He was a tireless organizer. He could sense the importance of a coming technical problem, promote a conference about it, find leaders for the meeting, obtain speakers and funding, and edit the proceedings. Usually he did this while remaining ostensibly in the background simply helping the organizing committee. To these skills is due much of the success of the Symposium on Accurate Characterization of the High Pressure Environment, in 1968, of which he was general chairman, and of the 1974 Airlie House Conference on Thermodynamics and National Energy Problems. All of us who worked with him will remember him as a gracious, cultured, imaginative and creative person, honestly interested in the welfare and the professional careers of his colleagues. Those of us who knew Charlie will miss him greatly.

David Garvin

Stanley Abramowitz

Ared Cezairliyan