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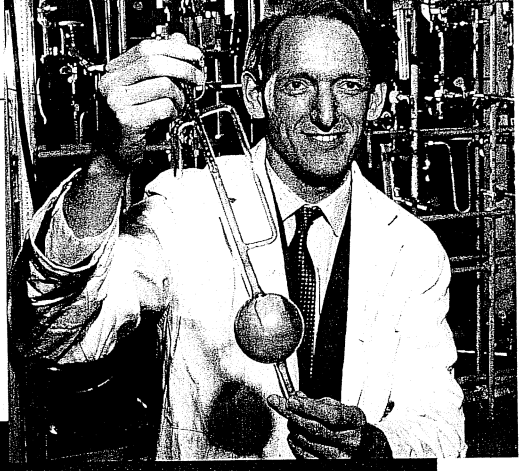
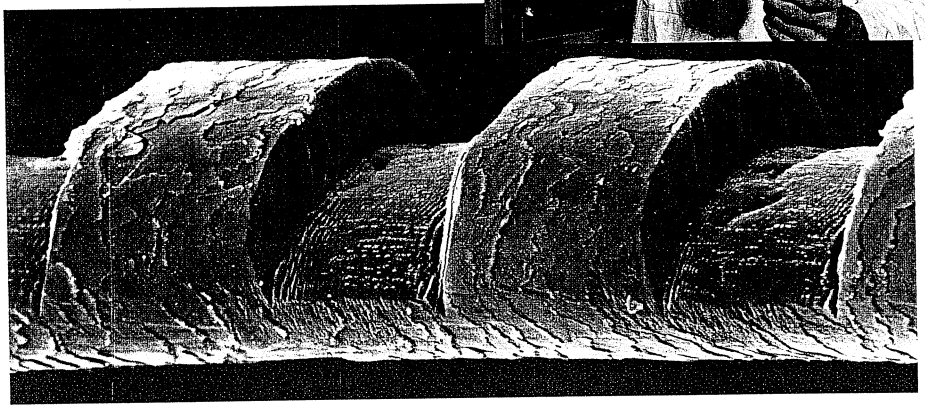
Historic Landmarks

Neil Bartlett and the Reactive Noble Gases



Neil Bartlett poses in his laboratory at the University of British Columbia, 1966. Courtesy of the University of British Columbia.



Notches etched in a human hair by an excimer laser. Courtesy of IBM.

In 2003 *Chemical & Engineering News* named Neil Bartlett's preparation of the first noble-gas compound as one of the 10 most beautiful experiments in the history of chemistry. Beautiful, as defined by *C&EN*, is "elegantly simple but significant." Beauty is subjective and significance also eludes quantification, but it would be difficult to exaggerate the importance of Bartlett's 1962 experiment, in which he mixed platinum hexafluoride, a highly reactive blood-red compound, with the noble gas xenon to form a yellow-orange salt. That simple experiment upset conventional scientific wisdom and forced chemists to rewrite textbooks.

Before Bartlett's experiment, scientists had believed that the noble gases, also known as inert or rare gases, could not form compounds because of the stability of their electronic structure, which hindered the gain or loss of electrons. The inertness of helium, neon, argon, krypton, xenon, and radon (all gases at room temperature) was a cornerstone of chemistry, incorporated in texts and taught in classrooms.

But, "in the twinkling of an eye," as he later recalled, Bartlett created the first noble-gas compound on 23 March 1962 in his laboratory at the University of British Columbia. Bartlett thought it "extraordinarily exhilarating"; other chemists were not so sure. Many expressed skepticism that one of the basic tenets of chemistry—the inertness of the noble gases—could be violated. But within months other scientists repeated his experiment and then chemists began to make new compounds from xenon and later from radon and krypton. Soon the old law of the inertness of the noble gases had been replaced by the new field of noble-gas chemistry.

Bartlett estimates that more than 100 noble-gas compounds are known today, and many more compounds are discovered every year. In 2002 researchers at the University of Helsinki formed the first and only known argon compound. Of the six noble gases, so far only helium and neon have resisted forming compounds.

Noble-gas compounds, despite their extreme instability and reactivity, can possess useful properties that have practical applications. They have been used to create antitumor agents, for example. Excimer (short for excited dimer) lasers use compounds of argon, krypton, or xenon to produce precise beams of ultraviolet light that are used in eye surgery to repair vision. Still greater rewards are expected in the future. Researchers have recently combined noble gases with hydrocarbons, an advance that might lead to new and better synthetic approaches to organic materials. Noble-gas compounds show promise as green-chemistry reagents for use in more environmentally friendly manufacturing processes.

Neil Bartlett was born 15 September 1932 in Newcastle-upon-Tyne, United Kingdom. He remembers conducting a laboratory experiment as a young boy in which he mixed a solution of colorless aqueous ammonia with blue copper sulfate in water, causing a reaction that, in his words, produced "beautiful, well-formed crystals." This early experiment not only got Bartlett hooked on chemistry but also vaguely foreshadowed his famous experiment decades later in which a similarly stunning chemical reaction produced the world's first noble-gas compound.

Bartlett's fascination with chemistry led him to build his own laboratory in his parents' home, complete with flasks and beakers and chemicals. He studied chemistry at King's College at the University of Durham, receiving a bachelor of science degree in 1954 and a doctorate in 1958. That year he was appointed a lecturer in chemistry at the University of British Columbia, eventually achieving the rank of full professor. In 1966 Bartlett became a professor of chemistry at Princeton University, and in 1969 he joined the faculty of the University of California, Berkeley, retiring in 1993. From 1969 to 1999 he also served as a scientist at the Lawrence Berkeley National Laboratory.

The American Chemical Society (ACS) and the Canadian Society for Chemistry (CSC) designated the work of Neil Bartlett as an International Historic Chemical Landmark on the afternoon of 23 May 2006 in a ceremony at the University of British Columbia in Vancouver. James D. Burke, chair of the ACS board of directors, presented the commemorative plaque to Grant Ingram, dean of science at the University of British Columbia. Among the speakers were Neil Bartlett and David W. Schwass, current president of the CSC. That evening a public lecture, "Chemistry—Just for the Love of It," was given at the university's downtown Vancouver campus by Joe Schwarcz, who appears regularly on the Discovery Channel's *Daily Planet* and is director for science and society at McGill University. ◎

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American Chemical Society