



Robert F. Curl, Jr. (1933–2022) structural chemist, Nobel laureate co-discoverer of buckminsterfullerene

Istvan Hargittai¹

Published online: 26 August 2022

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Robert F. Curl (1933–2022, Fig. 1) was born in Alice, Texas. He received his B.A. from Rice University in 1954 and his PhD from the University of California at Berkeley in 1957 under Kenneth S. Pitzer's mentorship. He spent the next academic year as a Research Fellow with E. Bright Wilson at Harvard University. He joined the Department of Chemistry at Rice University in 1958 and stayed there for his entire career. He rose to be the Harry C. and Olga K. Wiess Professor of Natural Sciences and later, the K. S. Pitzer-Schlumberger Professor of Natural Sciences. He retired in 2005, but he continued his work and active presence at the university. In 1996, he shared the Nobel Prize in Chemistry with Harold W. Kroto of the University of Sussex, England, and Richard E. Smalley of Rice University "for their discovery of fullerenes."

Curl's father was an itinerant Methodist minister, and they relocated often in various small places in Texas and also in the larger Austin and San Antonio. His father was deeply religious, which Curl never was. His father encouraged him to think about the world and bought him books to encourage his interest. Father and son would read these books together. Curl was 9 years old when his parents gave him a chemistry set as a Christmas present. He then spent a lot of time mixing up chemicals and became fascinated with colors and explosions. From that time, he knew he would become a chemist. Considering his childhood experiments, it is curious that he did not become a "wet" chemist, rather, a physical chemist focusing on structures and theoretical problems. Curl had two sons and tried to emulate his father's approach by giving them chemistry sets and electronic sets, but, to his chagrin, they were not interested.

I met Curl on several occasions at scientific meetings and enjoyed our conversations. He was always generous with his time. I knew all three laureates and published exchanges with each [1–3]. Curl was the most relaxed of the three and the least known. This is also why I decided to use this sad occasion to share what we talked about during the 17th Austin Symposium on Gas-Phase Molecular Structure in Austin, Texas, when we recorded a conversation on March 4, 1998 [1]. It was barely 10 weeks after Kenneth Pitzer's death, so we first talked about him. Pitzer was Curl's mentor for his doctoral studies and I had known of him from my organic chemistry studies and recorded a conversation with him at Berkeley in February 1996 [4].

Curl had also heard about Pitzer's contributions to structural organic chemistry in his senior year when he attended a course in natural products chemistry given by Richard Turner. One of Pitzer's well-known achievements was the reliable experimental determination of the barrier to internal rotation in ethane. Edward Teller and Bryan Topley communicated the first computed ethane barrier in 1935 and a few years later Pitzer provided reliable support for their results by low-temperature heat capacity measurements. By the time Pitzer mentored Curl in graduate school, Pitzer had considerably become involved in administration. So Pitzer was busy, but it was not his style anyway to interfere much in the work of his students, and Curl cherished independence. Later, when Curl was already a professor at Rice, Pitzer was the President of Rice University. They developed some joint work and co-authored a research paper. Curl was impressed by Pitzer at Rice for he brought substantial changes to the life of the university helping it to develop from a leading regional school into a leading school at the national level. Rice University used to discriminate against African-Americans in compliance with its original Charter. To have such discrimination ended was Pitzer's condition to accept the presidency. So the Board of Trustees went to Court to have it removed from the Charter. They started this in 1961, which was before the big civil-rights legislation of the mid-1960. Pitzer assumed the Rice presidency in 1962.

✉ Istvan Hargittai
stuceditor@gmail.com

¹ Department of Inorganic and Analytical Chemistry,
Budapest University of Technology and Economics,
POBox 91, Budapest 1521, Hungary



Fig. 1 Robert F. Curl, 1998, Austin, Texas (photograph by I. Hargittai)

Back still at Berkeley, as Curl was completing his doctorate, Pitzer helped him in securing a postdoctoral stint with E. Bright Wilson at Harvard University. So Curl had benefited from experience with two excellent scientists who were very different individuals. Pitzer was relaxed; Wilson took everything “seriously.” Curl learned from him microwave spectroscopy—a great tool for the determination of the geometry of rather simple molecules but with great accuracy. Curl used this tool for the next two decades at Rice University. Curl’s most important research was his participation in the discovery of buckminsterfullerene. The events about the discovery happened so fast that it would be difficult to determine with any certainty who did exactly what. The prize-winning contribution carried the names of five authors: three professors and two students [5]. Subsequently, it was Kroto and Smalley who became identified with the discovery and the more quiet and withdrawn Curl much less so. Two years before their Nobel Prize, Kroto told me: “Bob [Curl] was a key player in the whole programme – he was an equal co-worker involved in all the discussions during this period. I feel his role has not been recognized for various reasons.” ([2], p 343). Curl himself felt at times that his participation

was underplayed, especially in the popular press. However, he was happy to see that the two best seller books about the buckminsterfullerene discovery “gave a reasonably accurate historic account of what actually had happened” ([1], p 381). Curl agreed that it was difficult in hindsight to delineate the specific contributions, but in our conversation, he gave a detailed realistic account of who did what. Curl was modest and unassuming and perhaps for being so, his memories of the circumstances of the buckminsterfullerene discovery are trustworthy. He was most willing to describe them in our conversation.

The Nobel Prize did not change Curl. He knew that this exceptional recognition could open up new possibilities for him, and he chose the least glamorous one: he stayed in research and education. He knew also that he would not be able to produce anything even close to the significance of the buckminsterfullerene discovery, but he did not mind. At one of the conferences, years after the Nobel Prize, he reported his findings in a study of molecular properties by spectroscopic techniques. He was not particularly proud of it, because a lot of it was relatively old. He displayed self-deprecating humor as he characterized his own paper, quoting a famous review: “This paper contains many things that are new and interesting. Unfortunately, what’s new is not interesting and what’s interesting is not new.” ([1], p 381).

Many consider him to be a pioneer of nano-science and nanotechnology, a label that he never claimed. With Curl’s passing, the third and the oldest co-recipient of the fullerene Nobel Prize has departed, following Smalley (1943–2005) and Kroto (1939–2016). The world of science lost a significant contributor to research, education a beloved teacher, and all of us an exemplary human being.

References

1. Hargittai I (2000) *Candid science: conversations with famous chemists*. Edited by M. Hargittai, Imperial College Press, Chapter 29, “Robert F. Curl,” pp 374–387
2. Hargittai I (2000) *Candid science: conversations with famous chemists*. Edited by M. Hargittai, Imperial College Press, Chapter 26, “Harold W. Kroto,” pp 332–357
3. Hargittai I (2000) *Candid science: conversations with famous chemists*. Edited by M. Hargittai, Imperial College Press, Chapter 28, “Richard E. Smalley,” pp 362–373
4. Hargittai I (2000) *Candid science: conversations with famous chemists*. Edited by M. Hargittai, Imperial College Press, Chapter 35, “Kenneth S. Pitzer,” pp 438–447
5. Kroto HW, Heath JR, O’Brien SC, Curl RF, Smalley RE (1985) C_{60} : buckminsterfullerene. *Nature* 318:162–163

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.