Paul C. Lauterbur (1929–2007)

Paul Lauterbur, Professor of Chemistry at the University of Illinois, Urbana, and recipient of the 2003 Nobel Prize in Physiology and Medicine for the discovery of magnetic resonance imaging, died of kidney disease on March 27, 2007, at the age of 77.

His "long-awaited" Nobel Prize clearly met the criteria of Alfred Nobel's testament that the prize should be given to individuals "who have conferred the greatest benefit to mankind". Indeed, in his Nobel Lecture[1] he stated that "the most gratifying experiences emotionally were those when a stranger would volunteer 'you saved my daughter's life', or 'your machine saved me from an unnecessary operation'". Paul Lauterbur, however, was a pioneer of NMR spectroscopy long before he became widely known because of NMR imaging. For me as a member of the next generation of NMR spectroscopists it is interesting to remember whose papers we read during your own graduate work. Paul Lauterbur's were a "must" because of his early work on chemical shifts.[2]

Paul Lauterbur grew up in Sidney, Ohio, enjoying the pleasures as well as serving the duties of country life. He was independent right from the start, and upon graduation with a BSc from Case Western he "was tired of lectures and professors, and determined to get back to lab work." Rather than going to graduate school he joined Dow Corning at their Mellon Institute, which did, however, allow him to take graduate courses at the University of Pittsburgh.

There, he was intrigued by the observation that carbon black could be replaced by silica particles to dramatically improve the properties of natural or synthetic organic rubbers. After returning from military service, he was able to buy his own NMR machine. Rather than looking at ^{29}Si—after all, he was paid by a "Multiple Fellowship sustained by Corning Glass Works and Dow Corporation"—he focused on ^{13}C in natural abundance, because he "had calculated that, if ^{29}Si resonances could be seen, so could those of ^{13}C, and a much larger variety of stable carbon compounds existed than of silicon compounds." At the time,[2] however, Fourier transform NMR spectroscopy had not yet been invented, and despite its obvious analytical potential in chemistry and biochemistry, ^{13}C NMR spectroscopy remained almost a curiosity for more than a decade.

Being an independent person, Paul Lauterbur throughout his life disliked restrictions placed on his activities. He realized that to become more independent he had to get a PhD, which he eventually obtained in 1962 from the University of Pittsburgh. By that time he had already published 15 papers, including several pioneering ones. He looked for an appointment in academia, because, as he remarked,[1] "I wanted to be free to try any silly thing I decided to do." At the State University of New York at Stony Brook, where he was a Professor of Chemistry from 1963 to 1985, he found a position that fitted his needs. He happened to run across the observation that the ^{1}H NMR relaxation times differ in tumors and in normal tissues. This made him think about ways to locate where the NMR signals originate in complex objects. He realized that this could be achieved by applying linear magnetic field gradients to reconstruct an image from the spectra and called his invention "zeugmatography" from the Greek ζευγμα ("that which is used for joining"). His paper on the subject in *Nature*[3] is clearly fundamental, but the specific way of generating images by simple "projection reconstruction" turned out to be far too time-consuming. Magnetic resonance imaging (MRI), as the method is called today, could never have reached its ever-increasing importance in medicine and fundamental studies (e.g. for investigations of brain function) without the effective ways of generating images based on the pioneering work of Sir Peter Mansfield; Mansfield independently developed NMR imaging from a solid-state point of view (NMR diffraction) and, therefore, rightly shared the Nobel Prize with Lauterbur.

The development of MRI from the first demonstration in the early 1970s was accompanied by features often encountered when a discovery is obviously important and bears a high potential of earning prestige as well as money. Even from outside one could not escape the squabbles between the different groups. Naturally, Paul Lauterbur reoriented most of his research in this direction and spent 30 years developing techniques and applications of NMR imaging. None of the results he produced later, however, could match his original contribution. Thus, in spite of the many honors he received, he seemed to me to be somewhat dissatisfied and struggling for recognition. He moved to Urbana in 1985, but his work was hampered by legal disputes and the ever-changing plans of the university,[1] which eventually made him think of new directions in research concerning the origin of biology from a chemical point of view. His autobiography clearly shows how he enjoyed the final recognition by the Royal Swedish Academy of Sciences, which he must have experienced as a big relief. We lost a great chemist with seldom-met achievements in different fields.

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[1] P. C. Lauterbur, *Angew. Chem.* **2005**, *117*, 1026–1034; *Angew. Chem. Int. Ed.* **2005**, *44*, 1004–1011.
[2] P. C. Lauterbur, *J. Chem. Phys.* **1957**, *26*, 217–218; P. C. Lauterbur, *Phys. Rev. Letters* **1958**, *1*, 343–344.
[3] P. C. Lauterbur, *Nature* **1973**, *242*, 190–191.

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