# Opening the Door to the Information Age

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It's been 50 years since John Bardeen set out to build a better phone system. He and his partners at Bell Telephone Laboratories accomplished that goal and much more in 1947 when they created the first transistor, a device that replaced the vacuum tube and brought the world innovative, portable, reliable and inexpensive communication systems. For that, Bardeen earned, in 1956, the first of two Nobel prizes in physics — and opened the door to the information age.

"It was clear back then that inventing the transistor was a breakthrough," says William Bardeen, who was only 6 when his father taught him to say the word *transistor*. "But the pervasive effects today go beyond what anybody could have imagined." Bardeen speaks with dry humor about "the massive invasion of computer chips," chips that evolved from the transistor and are now found in everything from cars and dishwashers to radios, televisions and, of course, computers.

John Bardeen died Jan. 30, 1991, so he saw the popularity of computers among his children and grandchildren. He continued to immerse himself in research, advancing the frontiers of knowledge in his field. During his 60-year career, he made significant contributions to almost every aspect of condensed-matter physics. And in his 83rd year, he continued to publish original scientific papers. He was named by *Life* magazine as one of the 100 most influential people of the century.

He also understood it takes more than one's own skill to make a scientific breakthrough. "My father was noted as a person who thinks very deeply about things and works closely with the experimental people in the lab," says his son, who is a physicist at the Fermilab in Batavia, Ill. "At home, he didn't do repairs. He lacked the patience for practical things. But he was very persistent in solving theoretical problems."

And so he worked closely with Walter Brattain, whose strong point was experimenting in the lab. "The close relationship led to the discovery," says Bardeen. His father would come up with an idea, Brattain would test it in the lab, and then the two would try to figure out why it didn't work. "It was not just someone thinking it out in an ivory tower."

As a result, Bardeen shared the Nobel prize for the transistor with Brattain and William Shockley, another theoretical scientist who headed up the research team at Bell Labs. Shockley took the initial idea for the transistor and developed and expanded it to the form in which most transistors are used today.

Bardeen left Bell Labs in 1951 to become a professor of electrical engineering and physics at the University of Illinois. There Bardeen once again teamed up with other scientists, this time with L.N. Cooper and J.R. Schrieffer. The microscopic theory of superconductivity they developed has had profound implications on our studies of everything from elementary particles to the nuclear level, from helium liquids to neutron stars.

The trio won the Nobel prize in 1972. That honor placed Bardeen in the ranks of only three other scientists who have earned the Nobel prize twice: Linus Pauling, Frederick Sanger and Marie Curie.

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