

JOHN BARDEEN

When John Bardeen was awarded a second Nobel Prize in Physics, the only person ever to win two Nobels in the same field, he got a telegram from Leo Kadanoff saying: "Keep up the good work. Win three times and you get to keep the king."

Bardeen's first Nobel Prize, awarded in 1956 and shared with Walter Brattain and William Shockley, was for their research on semiconductors and their discovery of the transistor effect. His second Nobel Prize, awarded in 1972 and shared with Leon Cooper and J. Robert Schrieffer, was for the microscopic theory of superconductivity.

It is easy to argue about which of the two great achievements had a greater impact. Surely the transistor caused a revolution in technology and drastically altered society. But Bardeen was sure the BCS theory was more important to physics. Soon after the discovery of high-temperature superconductivity, Bardeen and I chatted at a 1987 Berkeley workshop. Usually, when I asked Bardeen what he thought about the significance of recent results in physics, it was hard to tell whether he was enthusiastic or not. This time, at the age of 79, he was clearly excited. He remarked that there hadn't been so many papers published about a new discovery since x rays were found, over 100 years earlier.

He was well known for his quiet, modest manner. His wife, Jane, recalls one day while he was at Bell Labs: He came home from work, parked the car in back of the house, and walked into the kitchen, where she was preparing dinner. "As you know, his voice was always very quiet. He said, 'We discovered something today.'" It was the



transistor.

Another such occasion is recalled by Charles Slichter. Bardeen stopped him in the hallway one day in the physics building at the University of Illinois—the morning after Bardeen, Cooper and Schrieffer had decided they had the BCS theory. Slichter reports: "It was clear he had something he wanted to say, but he just stood there. I waited. Finally he spoke up. 'Well, I think we've explained superconductivity.'" Although Bardeen was shy in many ways, Slichter says, "If there was something really big that he had done, he did want to tell someone."

Throughout his 60 years of research, Bardeen made significant contributions to almost every part of condensed matter physics. He continued to publish exciting science until his death at 82.

Bardeen moved easily in many circles—electrical engineering, mathematics, theoretical physics, science policy, industrial research and development. He began consulting for Haloid-Xerox in 1951 and continued in that role for Xerox until 1982. He also served on Xerox's board of directors from 1961 until the 1970s.

John and Jane Bardeen had three children. James does theoretical astrophysics and cosmology at the University of Washington; William is an elementary-particle theorist at Fermilab; Elizabeth (Betsy), who is married to MIT experimental low-temperature physicist Thomas Greytak, is a computer systems analyst at Arthur D. Little. The children don't remember their father trying to indoctrinate them in science, although Jim was reciting Newton's laws at the age of 3. Jim recalls that his father

“opened doors, but didn’t try to push us through them.”

Betsy recalls that Bardeen’s greatest love outside of physics was golf. He played whenever he could, wherever he was. When the children prepared a short biography for their father’s memorial service, after the list of his numerous prizes for physics and engineering, they cited the hole in one he got at a golf tournament held at the Champaign (Illinois) Country Club. Slichter tells the story of Bardeen’s long-time golf partner at the club remarking: “Say, John, I’ve been meaning to ask you. Just what is it you do for a living?” Slichter asks, “Can you imagine that? I think if I had won two Nobel Prizes like John had done, I would manage to work it into the conversation somewhere.”

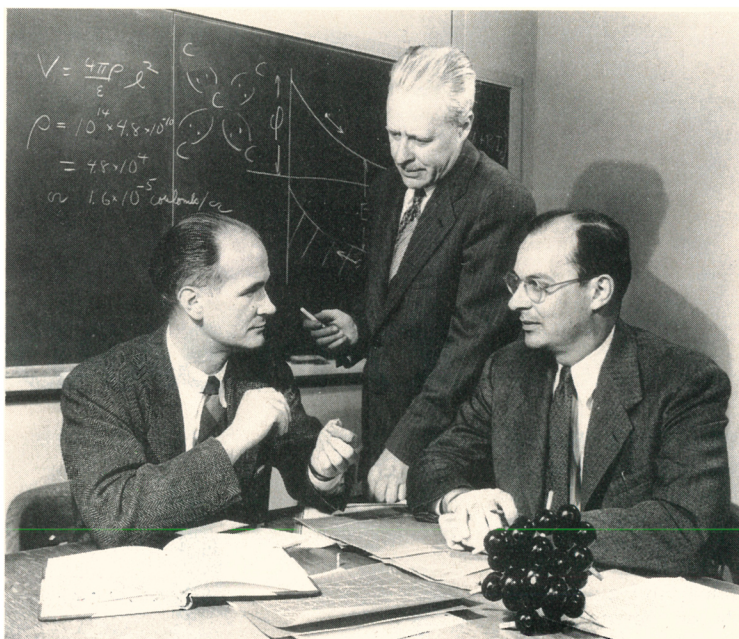
Born in Madison, Wisconsin, on 23 May 1908, Bardeen earned a BS and MS in electrical engineering at the University of Wisconsin in 1928 and 1929, respectively. He was a geophysicist at Gulf Research and Development Corporation in Pittsburgh from 1930 to 1933. In 1933 he returned to graduate work, studying mathematical physics at Princeton under Eugene Wigner. Bardeen received his PhD in 1936. From 1935 to 1938 he was a junior fellow of the Society of Fellows of Harvard University, where he worked with John Van Vleck and P. W. Bridgman.

He then went to the University of Minnesota as an assistant professor of physics. When the war came he worked at the Naval Ordnance Laboratory in Washington, DC. In the fall of 1945 he joined a newly formed research group in solid-state physics at Bell Telephone Laboratories. He left Bell Labs in 1951 to become a professor of electrical engineering and of physics at the University of Illinois. He remained there until his death on 30 January 1991.

This special issue of PHYSICS TODAY is dedicated to John Bardeen. Our authors—Conyers Herring, Nick Holonyak Jr, J. Robert Schrieffer, George Pake and David Pines—all spoke at the Bardeen memorial symposium held on 16 March at the Indianapolis meeting of The American Physical Society. The chairman of the symposium was Hans Frauenfelder.

GLORIA B. LUBKIN

Top: William Shockley, Walter Brattain and Bardeen at Bell Telephone Laboratories in 1947. (Courtesy of Walter Brown, AT&T Bell Laboratories.) **Middle:** J. Robert Schrieffer, Bardeen and Leon Cooper in 1974, when the University of Illinois awarded them honorary degrees. (Courtesy of Tom and Betsy Greytak.) **Bottom:** Bardeen in his 80s, holding a replica of the point-contact transistor. (Courtesy of Ansel Anderson, University of Illinois, Urbana-Champaign.)





Top left: Receiving the 1956 Nobel Prize in Physics from King Gustaf VI Adolf of Sweden. (Courtesy of Mrs. John Bardeen.)

Top right: At the 25th anniversary of the transistor, celebrated in 1972, Brattain (left), Bardeen and Shockley look pleased. (Courtesy of Tom and Betsy Greytak.)

Bottom left: At the podium during LT13, the low-temperature physics conference held at Boulder, Colorado, in 1972. (Courtesy of the National Institute of Standards and Technology.)

Bottom right: Banquet in honor of Bardeen's 60th birthday. Bardeen is at left, next to John Van Vleck. Brattain is at right, with his glass raised. (Courtesy of Anderson.)

