True Genius: The Life and Science of John Bardeen, the Only Winner of Two Nobel Prizes in Physics FREE

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tackled the structure of the tobacco mosaic virus, a subject more challenging than DNA. In his 1982 Nobel lecture, Aaron Klug—her closest collaborator and friend—acknowledged her contribution to his own work on molecular structure.

Maddox brings out one fact not generally known: *The Double Helix* was originally scheduled to be published by Harvard University Press. The outcry from eminent scientists and from Franklin's family was so intense that Harvard's board of overseers asked the press to drop the book. Atheneum later published it.

Maddox's mastery of historical detail gives us a definitive portrait of this warm and brilliant scientist and represents the science in an accurate and approachable way.

True Genius: The Life and Science of John Bardeen, the Only Winner of Two Nobel Prizes in Physics

Lillian Hoddeson
and Vicki Daitch
Joseph Henry Press, Washington, DC, 2002. $27.95 (367 pp.). ISBN 0-309-08408-3

Although many outstanding scientists are known for their outgoing dynamic personalities, John Bardeen, one of the most creative scientists of the 20th century, was a modest and quiet man. Yet he received two Nobel prizes in physics—one for the transistor (which revolutionized computers and communications) and one for the theory of superconductivity (one of the fundamental theoretical advances in recent times). *True Genius* gives an insightful and warm account of the scientific and personal life of this remarkable man.

Bardeen was the son of the dean of the University of Wisconsin–Madison Medical School. An outstanding student, he skipped from third to seventh grade. He majored in electrical engineering at the University of Wisconsin–Madison, where he took John Van Vleck's course on quantum mechanics—the first of its kind in the US. He then joined the research laboratory of Gulf Oil Co in Pittsburgh, where he worked on electromagnetic prospecting. The authors follow his career to Princeton, where he did his PhD thesis on many-body effects on metal surfaces. After a postdoctoral fellowship at Harvard, Bardeen joined the faculty of the University of Minnesota. There, he began his interest in superconductivity. Following Fritz London's ideas, he was convinced that there was an energy gap in the electronic spectrum that led to the expulsion of magnetic field.

After World War II, Bardeen joined Bell Laboratories in Murray Hill, New Jersey, where he worked on developing a semiconducting triode to replace the vacuum tube device, particularly in switching circuits. In a series of experimental and theoretical advances, Bardeen and Walter Brattain found that by placing two fine contacts at close spacing on a surface below which was a holelike semiconductor, they could achieve a 100-fold triode gain. As documented in the book, William Shockley, who led the group, thought he should receive the major credit for the discovery, because of an earlier suggestion of his (which proved to be incorrect). Shockley later developed the junction transistor, and the group shared the 1955 Nobel Prize in Physics.

In 1950, Bardeen moved to the University of Illinois, Urbana–Champaign, where he was able to pursue his interests in basic research. He founded a semiconductor laboratory and a theory group. Returning to his old interest in superconductivity, he brought together Leon Cooper (a postdoc with field-theory training) and me (as a graduate student). To attack the problem, Cooper found that two electrons above a frozen Fermi sea bind for all coupling strengths, which shows that the normal state is unstable. I found the wavefunction of the many-pair problem from which Bardeen proved there was an energy gap. Over a two-week period we were able to show that many of the theory's predictions were in agreement with experiment, with unique effects of the pairing correlations being observed.

True Genius relates how Bardeen taught his students to decompose a complex problem into simple pieces that preserve the physics. He was highly successful in using simple mathematics to analyze complicated problems: Stating the grand formalism often gets in the way of fundamental simple effects.

The book contains a collection of wonderful stories of how genius and humility can be combined to produce remarkable results. Having made a hole-in-one on the golf course, Bardeen was asked which was better: a Nobel Prize or a hole-in-one. He replied that he guessed two Nobel prizes were better.

I recommend this book as a joyous read.

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Journey from the Center of the Sun

Jack B. Zirker
Princeton U. Press, Princeton, N.J., 2002. $29.95. (302 pp.). ISBN 0-691-05781-8

Journey from the Center of the Sun is written with the experience, perspective, and insight of one who has spent decades in solar physics. Its author, Jack Zirker, graduated in 1996 to astronomer emeritus with the National Solar Observatory at Sacramento Peak, New Mexico. During his career, he contributed to solar physics as observer, experimentalist, theorist, and observatory director. In his own words, "[I] wrote this book because I wanted to share some of my pleasure in the subject. . . . I wanted to try to explain how the Sun works, the physical principles that govern its behavior, the many things we have learned since Sputnik, and the long list of things we still don't understand to our satisfaction." In these objectives he has been abundantly successful.

Solar physics is challenging and provocative because so much observational detail is available and so much remains to be puzzled out. The nearness of the Sun, with its generous photon, particle, and magnetized plasma fluxes, enables discovery of physical details inaccessible from any other astrophysical source. As a magnetically variable star, the Sun yields extravagant observational phenomena that need to be understood and explained from first principles. As Zirker says, "the more information one has, the more complex the phenomenon seems to become." The very core of the Sun is observable in neutrinos; the interior down to about 0.1 of the solar radius is studied with exquisite precision by helioseismology. Above the photosphere layer (where radiation can escape), the real fun begins: One can observe radiation from gamma-ray to kilometer wavelengths. Outside the magnetosphere of Earth, in situ measurements directly probe the solar wind, solar cosmic rays (energetic charged particles from flares and interplanetary shocks), and magnetized clouds.

Zirker sets out to deal with it all, and does an admirable job. He fits the many pieces together in an eminently satisfying manner. The book is free of mathematics but replete with illuminating cartoon illustrations and minigraphs, which, with only a couple of exceptions, are well integrated into the text. The typography is attractive and readable, with plenty of room in the margin for notes. In this era of brilliantly colored