BOOKS: HISTORY OF PHYSICS

# Tangled Causes of the Bomb's Creators

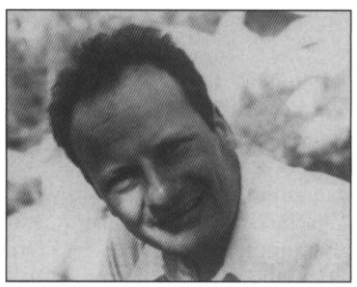
Richard Rhodes

"With the discovery of [nuclear] fission," C. P. Snow once commented, "...physicists became, almost overnight, the most important military resource a nation-state could call upon." Their primacy as a resource opened the way for physicists to influence national policy and international affairs. Both developments demanded grave moral choices because through the discovery of nuclear fission humankind for the first time acquired the means of its own destruction. Physicist and science historian Sam Schweber's *In the Shadow of the Bomb* explores the ethical dilemmas that Robert Oppenheimer and Hans Bethe confronted as prominent participants in the development of U.S. nuclear weapons and compares the moral choices each made.

**In the Shadow of the Bomb**
**Oppenheimer, Bethe, and the Moral Responsibility of the Scientist**
*by S. S. Schweber*
Princeton University Press, Princeton, NJ, 2000. 278 pp. $24.95, £15.95. ISBN 0-691-04989-0.

The two men first worked together at Berkeley in the summer of 1942, when Oppenheimer convened a colloquium to review bomb physics. After Oppenheimer became director of the Los Alamos Laboratory early in 1943, he chose Bethe to guide the Lab's theoretical physics division. Oppenheimer was Jewish, Bethe an émigré from Nazi Germany, and both believed the survival of Western civilization depended on the Allies beating Germany to the atomic bomb. At the end of the war, Bethe returned to research and teaching but continued to contribute to weapons work as a consultant. Oppenheimer, more conflicted, accepted celebrity as a physicist-statesman and popular hero but confessed to Harry Truman that he had blood on his hands.

Through the remainder of the 1940s, Oppenheimer worked simultaneously to create a system of international control of atomic energy and to build up U.S. stocks of atomic bombs. He helped draft the Acheson-Lilienthal plan for placing all developments in atomic energy under international control. Weakened and renamed the Baruch Plan, this proposal was rejected by the United Nations primarily because the Soviet Union was not prepared to give up an advantage it had not yet acquired. But the plan remains the best model yet devised for an open world in which mutual surveillance substitutes for weapons stockpiles. When Oppenheimer's mortal enemy Lewis L. Strauss (a wealthy investment banker, conservative Republican presidential adviser, and physicist manqué) took over the chairmanship of the U.S. Atomic Energy Commission (AEC) in 1953, his first priority was to expel from government the charismatic physicist who had ridiculed his pretensions and whom Strauss privately believed to be a Soviet spy. Oppenheimer's complicated security files and his opposition four years previously to a crash program to build a hydrogen bomb gave Strauss occasion. He succeeded, and Oppenheimer lived out the rest of his life a broken man.



**Before the bomb.** Bethe at Los Alamos during World War II.

In Schweber's characterization, Oppenheimer compares unfavorably to Bethe, who followed a more modest but effective course of continued research and teaching outside of government service while consulting and advising part-time from within. Bethe, the author writes, "considers his efforts in ending the era of extensive atmospheric testing, and the role he played in having issues of arms reduction discussed and taken seriously at the highest levels of the U.S. government, his most valuable and important contributions as a scientist in the political arena." And those efforts are in addition to "the influential role he has played in the debates over anti-ballistic missiles, the Strategic Defense Initiative, energy, and nuclear energy." It should be noted, however, that Schweber is Bethe's authorized biographer, and the author acknowledges knowing Bethe's career in greater detail than he knows Oppenheimer's. Bethe has the advantage as well of having lived a long and productive life, which happily continues to this day.

But Schweber misses at least one crucial fact about Oppenheimer's security problems that should be taken into account when judging him for implicating others as security risks, a subject to which Schweber devotes considerable attention. Though the facts are reported in the official AEC history, Schweber seems not to know that Oppenheimer's younger brother Frank was solicited (unsuccessfully) for Soviet espionage in 1943 by their mutual friend Haakon Chevalier and that Oppenheimer had somehow convinced General Leslie R. Groves, the head of the Manhattan Project, not to report the contact to the FBI. The "cock-and-bull story," as Oppenheimer called it, that he gave to wartime security officers to cover his tracks and protect his brother came back after the war to haunt him. Implicating others to protect your family is less than admirable, but it at least helps explain what must otherwise seem inexplicably devious. Schweber writes more than once of Oppenheimer's "frailty of...character"; knowing this crucial fact might have added a little bracing to the model Schweber constructs.

Although Bethe, for his part, from 1942 onward debated within himself (and with his wife Rose) the morality of working on weapons of mass destruction and publicly stated his opposition to working on the hydrogen bomb, he managed to find reasons to do so. Given that record, the statement he issued at Los Alamos on the 50th anniversary of the atomic bombing of Hiroshima, which called on "all scientists in all countries to cease and desist from work creating, developing, improving, and manufacturing further nuclear weapons" and other weapons of mass destruction, rings hollow.

**Searching for Trinity.** Oppenheimer photographed on the Valle Grande rim, New Mexico, during an early May 1944 trip to select the test site for the first atomic bomb.

My point is not to criticize Bethe but to sharpen the focus of Schweber's somewhat diffuse case study of the moral responsibility of scientists. Both Oppenheimer and Bethe served what Oppenheimer once called "the

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historically hardly paralleled dedication and responsibility of physicists to the great, dark, tangled, un-understood cause of a peaceful world" when they worked to shape the future not by rhetoric but by concrete action. Although Oppenheimer's personal flaws as well as his political convictions brought him trouble, such facts should not obscure his profound achievements: the bomb itself, which ultimately reined in national sovereignty by scaring the hell out of even the most belligerent nations and leaders, and a clearer understanding of how the human world might accommodate a scientific discovery with millennial implications. Similarly, Bethe's pronouncements reflected an uneasy conscience; but his laborious and fruitful efforts toward limiting the excesses of the nuclear arms race, which his great and well-earned scientific reputation supported, have earned him the right to put his conscience at ease. The example of these two men, which *In the Shadow of the Bomb* valuably examines, is one that scientists and nonscientists alike would do well to take to heart.

BOOKS: CHEMISTRY

# Realm of the Rainbow

**Thomas Lazar**

**Mastery of color.** The radiant ultramarine of the sky in *Bacchus and Ariadne* (1523) is only one of the brilliant pigments that Titian used to make color the prime compositional element of his paintings.

CREDIT: ERICH LESSING/ART RESOURCE

Colors are part of our daily lives, yet color is not an easy concept to tackle. The phenomenon's many facets include the physical processes that generate differential spectral displays we may perceive as color, the neurophysiological events that form our perception, psychological effects, and aesthetics. Refraction, reflection, interference, and the perturbation of electron configurations produce photons of certain energy states that we perceive as color. But neurobiological research has shown that colors exist only in the brain. Nevertheless, they are biologically engrained in our minds, so we react to them in a blend of inborn and culturally modified ways. Red roses attract, but blue pasta repels.

Although the creation of color in the back of our heads by the brain's interpretation of differential arousal of retinal neurons may seem the most awesome aspect of the phenomenon, color perception is not an end in itself. It developed during evolution to enhance fitness. Colors provide a versatile means of communication. They are exploited by flowers to attract insects, by squids to display their moods, and by birds to attract mates. Many organisms perceive spectra we cannot see, but do they see color? Certainly not as humans do, with a psychological impact that artists have exploited for centuries. Through this impact, the subject of color extends well beyond science into the realms of art, literature, and culture. Any final judgment on colors must therefore be subjective.

**Color**
**A Multidisciplinary Approach**
*by Heinrich Zollinger*
Wiley-VCH, Weinheim, and Verlag Helvetica Chimica Acta, Zürich, 1999. 268 pp. $120, £70, DM198, EUR101.24, sFr176. ISBN 3-906390-18-7.

In *Color*, Heinrich Zollinger pays ample attention to all of the above aspects of the intriguing phenomenon. Zollinger, an emeritus professor at the Swiss Federal Institute of Technology in Zurich, developed a passion for the subject during his long career as a specialist on color and textile chemistry. He has also published papers on the naming of colors, and he even admits to having once spent more of a sabbatical at the Massachusetts Institute of Technology studying linguistics than teaching dye chemistry. Zollinger's inquisitive mind has led him to master an impressive array of topics and integrate contributions from disparate disciplines into an enjoyable account. His book provides a very balanced treatment of the spectrum between red and violet.

Zollinger's easy-to-grasp writing is accompanied by informative graphics and many high-quality reproductions of photographs and paintings. His descriptions and, often personal, interpretations of individual topics require no prior knowledge beyond a basic understanding of scientific concepts, one which readers of *Science* can be assumed to possess.

Specialists may wish that their particular fields were given more detailed treatments, but it is the breadth of the book's scope that makes *Color* so fascinating. Zollinger's account is itself a kaleidoscope of color. The chapters proceed in a logical order from the physics of light and the chemistry of colorants, through the biology of vision, to the culture of visual arts. Each, however, can be read independently, which makes it easy to dive into the text, wherever one is lured. After exploring Zollinger's varied perspectives, readers will look at the colorful world around them with increased awareness and appreciation.

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