Doomed to Cooperate: How American and Russian Scientists Joined Forces to Avert Some of the Greatest Post–Cold War Nuclear Dangers

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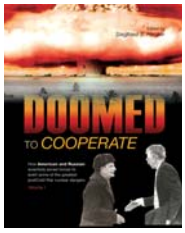

Edited by Siegfried S. Hecker

Bathtub Row Press, 2016. 2 vols. $80.00 (976 pp.).
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The collapse of the Soviet Union in 1991 created unprecedented dangers. The crumbling empire had thousands of nuclear weapons, enough material to make tens of thousands more, and tens of thousands of experts with sensitive nuclear expertise. To overstate only slightly, *Doomed to Cooperate: How American and Russian Scientists Joined Forces to Avert Some of the Greatest Post–Cold War Nuclear Dangers* is a true story of scientists and engineers successfully working together to save the world.

Doomed to Cooperate is edited by Siegfried Hecker, a former director of Los Alamos National Laboratory and a central participant in the events described. The book tells the story of how US and Russian scientists threw themselves into the job of preventing catastrophe, with a "lab-to-lab" effort that pushed the frontiers of science; beefed up security and accounting for nuclear materials; and strengthened the technical foundations for stewardship of their countries' nuclear arsenals. (See also the article by Hecker, PHYSICS TODAY, July 2011, page 31.)

It is, as former undersecretary of energy Charles Curtis notes in the foreword, "a story of heroes," of scientists succeeding in prying open and leaping through the slimmest of windows of opportunity—and of visionary government officials, including Curtis himself, backing them and giving them the freedom to seize chances as they arose. It is a tale that holds lessons that the governments of the US and Russia would do well to remember.

Hecker, working with colleagues Rady Ilkaev and Evgeny Avrorin—former directors of Russia's two main weapons labs—has pulled together firsthand accounts from some 100 US and Russian (with one Kazakh) participants. The two-volume set is divided into sections on different aspects of the cooperation, including nuclear weapons and material security, stockpile stewardship, fundamental science, conversion from defense work to civilian work, and the human dimension of the effort. Hecker provides readable and informative introductions to each of the sections. Unfortunately, US–Russian tensions forced Ilkaev and Avrorin to pull out as formal coeditors of the English-language volume; they plan to put out a Russian volume that will include their introductions.

By sheer historical luck, just before the Soviet collapse, US and Soviet weapons scientists had made contact and started developing relationships as they worked together on the Joint Verification Experiment, a project that developed and demonstrated technologies for measuring the yields of nuclear tests. The Soviet team was led by the redoubtable Viktor Mikhailov, who would later become the first minister of atomic energy of an independent Russia. In that role, he would provide crucial top cover for his scientists' cooperation with the Americans.

Those personal relationships between Cold Warriors who had built nuclear weapons designed to destroy each other's countries proved crucial in the wake of the Soviet dissolution. As Hecker recounts, in 1990, a year before the collapse of the Soviet Union, Mikhailov invited US weapons-lab scientists to visit the secret cities that held the Soviet weapons labs—an unprecedented event. When the Americans arrived, the Russians already had proposals for scientific cooperation ready to go, and in later letters they proposed an exchange of visits between the US and Russian labs.

Hecker struggled to get US government approval to let American weapons scientists talk to their Russian counterparts. He finally convinced then secretary of energy James Watkins at a fateful meeting in early December 1991, just weeks before the Soviet collapse. By February 1992, Russian lab directors were visiting Los Alamos and Livermore National Laboratories, and Hecker and John Nuckolls, then director of Livermore, were visiting Sarov and Snezhinsk, homes to the two main Russian nuclear weapons labs.

From there, work progressed quickly—first in basic science, such as the physics of extreme magnetic fields, and then, once trust had been built, on upgrading what came to be called nuclear material protection, control, and accounting (MPC&A). Ultimately, joint work ranged from pulsed power to plutonium science, and from new medical technologies to new technologies and procedures for verifying nuclear warhead dismantlement. The collaboration led to more than 400 published articles and conference papers.

The MPC&A work was particularly urgent. Much of the Soviet nuclear security system had collapsed with the Soviet Union. The MPC&A work had been proceeding at a glacial pace, but the trust and sense of common purpose built in the lab-to-lab collaboration enabled a rapid breakthrough in 1994, when the scientists installed modern security and accounting systems for a few buildings and began laying plans for deploying them throughout Russia's nuclear complex. Eventually, those personal relationships even made it possible to overcome the barriers to providing security both for the highly enriched uranium fuel used in Russia's nuclear navy and for nuclear warheads.

Twenty-five years after the collapse of the Soviet Union, it is hard to remember what an unnatural act that cooperation was. The Soviet nuclear security system had been intended primarily to keep out US spies. It required a wrenching shift of mental gears for Russian security managers to be convinced that allowing Americans inside their most sensitive facilities was part of the answer rather than part of the problem.

A complementary shift had to happen on the US side. As Hecker reports, "very few in our government understood or believed that a weak Russia in political turmoil and with an economically stressed nuclear complex was a greater threat than a stronger, more stable Russia."

Unfortunately, most officials in Washington and Moscow today have forgot-

ten the lessons of the lab-to-lab experience. Spiraling tensions have led to a cutoff of almost all US–Russian nuclear cooperation. Yet, although the conditions of the 1990s will not be re-created, it remains true that the US and Russia share fundamental interests in nuclear safety and security. US and Russian technical experts are still able to cooperate toward those ends, and their personal relationships, based on trust and professional respect, can still help to overcome obstacles that officials negotiating at headquarters would find more difficult to breach.

One hopes that *Doomed to Cooperate* will help a new generation of US and Russian officials learn the lessons from the 1990s and allow the experts to reengage in the effort to prevent catastrophe, build understanding, and explore new technologies and scientific frontiers.

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Why Quark Rhymes with Pork

And Other Scientific Diversions

N. David Mermin

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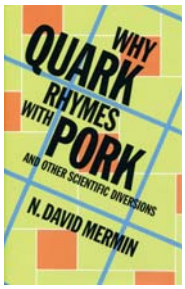
The contents of many nonfiction books can be summarized as "the blurb spread thinly," but that's an accusation that cannot be levied at David Mermin's new essay collection, *Why Quark Rhymes with Pork: And Other Scientific Diversions*. The best summary I could come up with is "things David Mermin is interested in," or at least was interested in at some point during the past 30 years.

That isn't as undescriptive as it seems. Mermin is a Horace White Professor of Physics Emeritus at Cornell University and a well-known condensed-matter physicist. He is active in science communication and famous for both his dissatisfaction with the Copenhagen interpretation and his obsession with properly punctuating equations. That's also what his essays are about: quantum mechanics, academia, condensed-matter physics, writing in general, and obsessive punctuation in particular. *Why Quark Rhymes with Pork* collects all of Mermin's Reference Frame columns published in PHYSICS TODAY from 1988 to 2009, updated with postscripts, plus 13 previously unpublished essays.



The earliest of Mermin's Reference Frame columns stem from the age of handwritten transparencies and predate the arXiv, the Superconducting Super Disaster, and the "science wars" of the 1990s. I read those first essays with the same delighted horror evoked by my grandma's tales of slide rules and logarithmic tables, until I realized that we're still discussing the same questions that Mermin did 20 years ago: Why do we submit papers to journals for peer review instead of reviewing them independently of journal submission? Have we learned anything profound in the past half century? What do you do when you give a talk and have mustard on your ear? Why is the sociology of