RETROSPECTIVE

Paul Mead Doty (1920–2011)

Matthew Meselson

A chemist, whose DNA work underlies powerful biochemical and genetic tools, sought to control nuclear arms and foster science communication to policy-makers.

Paul Mead Doty, early leader in applying physical chemistry to the study of synthetic polymers, proteins, and nucleic acids and in the efforts of senior U.S. scientists to bring arms control thinking to governments on both sides of the Cold War, mentor and constant friend to many in both fields, died on 5 December at age 91 at his home in Cambridge, Massachusetts.

Born 1 June 1920 in Charleston, West Virginia, the only child in a family of modest means, Doty grew up in the small town of Chicora, Pennsylvania. He majored in chemistry at Pennsylvania State University and received his doctorate in chemistry in 1944 at Columbia University. There, he and his fellow graduate student Bruno Zimm began to adapt Peter Debye's theory of light scattering to the study of large molecules in solution, a field that occupied much of Doty's early research. During 1943 to 1946, he was instructor and then assistant professor and codirector of wartime Army Quartermaster projects at Brooklyn Polytech in the Institute of Polymer Research, the foremost center of polymer science at the time. As a Rockefeller Fellow at Cambridge University in 1947, he was influenced by Max Perutz to turn his research to the study of macromolecules of biological importance. After a year as assistant professor at the University of Notre Dame, Doty was appointed assistant professor at Harvard, becoming full professor in 1956. One of the major interests in the laboratory was the physical chemistry and then the gene structure of collagen, resulting in a long series of publications coauthored by Paul and his wife, Helga Boedtker Doty, and, later, by her alone.

Doty's seminal contribution to science was the discovery that the separated chains of the DNA double helix can be specifically reunited. It was known that the two chains of the double helix could be separated by heating. But Doty's laboratory showed that the separated chains could be rejoined by incubation in solution a few degrees below the melting point, a result that came as a surprise to many. Concern that the initial observations might be due to internal folding or aggregation were decisively put to rest in a

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series of papers by Doty, his postdoctoral associate Julius Marmur, and others in the Doty laboratory in 1960 and 1961. The discovery opened the way to the development of many of the most powerful and widely employed methods of biological investigation and genetic engineering in current use, including primer-initiated DNA sequencing, polymerase chain reaction, and chip-based analysis of transcription.

At Harvard, in part because he had become a trusted adviser to Dean McGeorge Bundy, Doty became highly effective in building molecular biology as a field distinct from traditional biology and chemistry, first in recruiting James Watson as assistant professor and later in creating a separate department, Biochemistry and Molecular Biology (BMB). Nearly all of the 16 eventual members of the new department were or became members of the U.S. National Academy of Sciences, and three received Nobel prizes. BMB existed for 27 years, from 1967 to 1994, until merging with Harvard's more traditional biology department. By the time Doty became emeritus professor in the Faculty of Arts and Sciences in 1988, he had supervised the work of some 150 undergraduate, graduate, and postdoctoral researchers, many going on to make important contributions to chemistry and molecular biology.

Doty's other professional life, equally creative, was at the intersection of science and public affairs. As chairman of the Federation of American Scientists, he was invited to the initial meeting of the Pugwash Conferences on Science and World Affairs in 1957. There he began a dialogue with senior Soviet scientists that continued throughout his life. His diary for a 1960 trip to Russia records his impression that "Surely the accessibility of at least a part of the Russian scientific community to normal contact with Western scientists and the relatively large extent to which their thinking is not subject to ideological criteria should be recognized as a bridgehead through which understanding may be expanded." There followed some 40 more trips to Russia and many meetings in the West with Russian scientists sufficiently respected by Soviet leaders to gain a serious hearing.

Doty was an initial member of President Kennedy's Science Advisory Committee, the Committee on International Security and Arms Control of the National Academy, and the Aspen summer workshop on arms control, which he founded. In 1974, with support from the Ford Foundation, Doty founded Harvard's Center for Science and International Affairs, later renamed the Belfer Center, and its journal, *International Security*. A leading center for scholarship and training in diverse aspects of science and international affairs, many of its alumnae went on to occupy top academic posts and/or high government positions in defense and foreign policy in the United States and abroad. Doty's style as director there was the same as in the laboratory—questioning, encouraging, and oblivious to seniority. In both, he consistently cut to the heart of a problem, caring more about finding answers than about promoting his own prestige or power.

The premise of Doty's approach to international security matters was that nuclear weapons are not for war-fighting or preemption but solely for deterring nuclear attack, the only role that might avoid their use entirely. Especially in the early years of the Cold War, this was by no means the settled view among senior officials on either side. Doty's influence on many who went on to occupy key positions in government and his leading role in the effort of U.S. and Soviet scientists to promote arms control must surely have helped to avoid catastrophe.

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