Warren Weaver

Born July 17, 1894, Reedsburg, Wis.; died November 24, 1978, New Midford, Conn.; World War II director of the Applied Mathematics Panel of the NDRC,[1] whose work showed the full possibilities of the applications of mathematics to the problems of war-and in turn the application of computational devices to myriad applications; originator in 1946, in a discussion with Andrew Booth, of the idea of translating languages with a computer.

Education: BS, mathematics, University of Wisconsin, 1916; CE, University of Wisconsin, 1917; PhD, mathematical physics, University of Wisconsin, 1921.

Professional Experience: assistant professor, Throop College of Technology, 1917-1918; assistant professor, California Institute of Technology, 1919-1920; University of Wisconsin: assistant professor, associate professor, 1920-1928, professor, and department chairman, 1928-1932; Rockefeller Foundation: director, Natural Science, 1932-1955, vice president, Natural and Medical Sciences, 1955-1959, vice president, 1959-1964; consultant, Science Affairs, Alfred P. Sloan Foundation, 1964-onwards.

Honors and Awards: LLD, University of Wisconsin, 1948; ScD, University of Sao Paulo, 1949; ScD, Drexel Institute, 1961; DEng, Rensselaer Polytechnic, 1962; LHD, University of Rochester, 1963; ScD, University of Pittsburgh, 1964; ScD, New York University, 1964; US Medal for Merit, 1948; officer, Legion of Honour, France, 1950; Public Welfare Medal, National Academy of Sciences, 1957; British King's Defense Freedom Medal, 1965; Kalinga Prize and Arches of Science Award, 1965; fellow, American Physical Society; member, National Academy of Sciences.

Warren Weaver started his career as a teacher of mathematics. But before his 38th birthday he became a foundation executive, when he accepted the post of director of the Division of Natural Sciences of the Rockefeller Foundation. In that role he exercised a profound influence on the development of biology worldwide, and it was probably for this that he was best known during his lifetime. During his years as an officer of the Rockefeller Foundation, however, and during his service as an officer of the Sloan Foundation after his retirement from his Rockefeller post, his influence on many other aspects of science expanded and its impact was broadly felt.

Weaver was born on July 17, 1894, in the little town of Reedsburg, Wisconsin. As a child he was shy, introspective, unskilled in sports, and often lonesome. When he was a youngster, his father, who was a pharmacist, made an annual buying trip to purchase the drugstore's supply of Christmas toys for the coming holiday season. It was traditional for him to return with a gift for each of the boys in the family. After one of these trips, Warren received a small electric motor powered by a dry cell battery. It was labeled “Ajax” and cost a dollar. From experiments with this motor, which included taking it apart and rewiring and rebuilding it, Weaver was first exposed to science and engineering. From this experience he assumed without question that he was destined to be an engineer.

[1] National Defense Research Committee.

It was at the University of Wisconsin that Warren, studying “Advanced Mathematics for Engineers,” realized that his enthusiasm was for science rather than for engineering. He decided to pursue a graduate degree in mathematics and theoretical physics as soon as this proved feasible. Immediately after receiving a degree in civil engineering in 1917 (he had earned a BS in mathematics in 1916), he accepted an invitation from Robert A. Millikan to become an assistant professor of mathematics at Throop College (soon to be renamed the California Institute of Technology). Weaver had been at Throop less than a year when he was drafted into the Army at the request of Charles E. Mendenhall, chairman of the Physics Department at Wisconsin. Mendenhall was then serving as a major in the Army's unit associated with the newly formed National Research Council. Weaver was assigned to participate in one of the technical efforts to develop effective equipment to assist US aviators in the air battles of World War I.

After a brief interlude at Wisconsin and a year at Pasadena, as the end of the 1920 academic year approached a letter from Madison invited Weaver to join the faculty at the University of Wisconsin. There was also a most important letter from Max Mason, who urged Warren to accept Wisconsin's offer, and suggested that they work together on a book on electromagnetic field theory.

In 1921 Weaver earned his PhD; his collaboration with Mason began promptly and was vigorously pursued. In 1925, however, Mason left to become president of the University of Chicago, while Weaver carried on alone in Madison, sending drafts to Mason in Chicago. In 1928 Weaver succeeded Edward Burr Van Vleck as chairman of the Department of Mathematics. The Mason-Weaver book *Electromagnetic Field* was published in 1929. For some years thereafter, it was the book from which many graduate students in physics learned Maxwell's field equations and the associated theory. For occasional physicists whom he met in later years, Warren became the 'Weaver, of Mason and Weaver.”

In the fall of 1931 Mason invited Weaver to visit him in New York to discuss the possibility of his joining the staff of the Rockefeller Foundation as head of its program in natural sciences. The Rockefeller Foundation had recently been reorganized, absorbing several other Rockefeller agencies that had been founded for special purposes but no longer required separate settings. The foundation's aim “to promote the well-being of mankind throughout the world” was interpreted by the trustees as being served, in the immediate future, by support of the scientific research of individuals.

From the beginning, Weaver's duties at the Rockefeller Foundation required fairly regular travel to Europe, and later to other parts of the world. During his trips in the early 1930s he became acquainted with many of Europe's leading scientists whose work lay in the areas of the foundation's interest. His conversations with German scholars in those years convinced him of the imminence of worldwide conflict.

In 1940 at the invitation of President Roosevelt, Vannevar Bush set up an organization, the National Defense Research Committee (NDRC), to aid the military services with their scientific problems. Weaver wrote to Bush offering his services on a full-time basis. He also took a step motivated by his memory of World War I and the destruction of European libraries that ensued. With the support of the Rockefeller Foundation trustees, he arranged for the American Library Association to administer a grant “for the purchase or reproduction of American scholarly journals for institutions in areas of war damage, chiefly in Europe and Asia.” A first-rate librarian was employed, and a large empty loft was rented in Washington. The librarian made a list of university libraries in Europe and the developing countries, including those of Socialist governments, and entered subscriptions for all the professional journals in the US. As the journals were published, copies were deposited in bins marked “Library of the Sorbonne,” Library of the University of Heidelberg,” “Library of the University

of Louvain," and so on. At the end of the war, the complete series of journals was boxed and ready for shipment to these libraries as the rubble was being cleared.[1]

In July 1940 Bush invited Weaver to set up the fire-control section of NDRC. Weaver accepted and planned to resign from the Rockefeller Foundation. But he was persuaded to retain his appointment there, carrying on some of his usual duties while giving first priority to the NDRC functions.

The NDRC fire-control unit was working on sighting systems to be used for directing the guns of an airplane against enemy aircraft, and on bombsights for such uses as low-level attacks on submarines. But the largest and most useful of the projects sponsored by the section was the design and development of a successful antiaircraft director. In February 1942 the revolutionary instrument was accepted by the Army as the M-9 Director. It was ready in time to join radar and the proximity fuse, which was also developed by Bush's organization, in reversing the tide of the later parts of the Battle of Britain-saving London from the worst destruction threatened by the German V1 devices (buzzbombs [doodle bugs]) that began to rain on the city in 1944.

By late 1942, Bush had identified the increasing need for sophisticated mathematical studies, and the greatly expanded need for mathematical assistance in NDRC. He established the Applied Mathematics Panel (AMP) with Weaver as its chief-, Harold Hazen of MIT became chief of the fire-control division. Weaver's skill in the administration of research and his effectiveness in dealing with military officers and with the Washington bureaucracy greatly facilitated the work of the AMP. During the war, the panel received many letters of appreciation from military commands; at war's end, several of the war-born research projects were continued with support from interested military agencies. For his war work, Weaver received the King's Medal for Service in the Cause of Freedom from Great Britain, and the Medal of Merit of the US. In 1950 he was made an officer of the Legion of Honour of France. The citation that accompanied the US Medal of Merit read, in part: "He revolutionized anti-aircraft fire control. He made brilliant contributions to the effectiveness of bomber aircraft. The work of his Panel showed the full possibilities of the applications of mathematics to the problems of war."

Warren Weaver was a man whose company was a constant source of stimulation to those who were closely associated with him. He was a prodigious worker and a man for whom the conquest of a new and difficult idea, particularly in science, was an event of importance. He viewed science as the most successful of man's intellectual adventures, and in some senses his whole life was devoted to science.[2]

QUOTATION

"The most imaginative and powerful movements in the history of science have arisen not from plans, not from compulsion, but from the spontaneous enthusiasm and curiosity of capable individuals who had the freedom to think about the things they considered interesting."

[1] Interestingly, some of the losses to library holdings in eastern Europe may have been the result of Soviet "reparations" at the end of the war.

[2] Extracted from Rees 1983.

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UPDATES

Portrait added (MRW, 2013)