A Classic Instrument: The Beckman DU Spectrophotometer and Its Inventor, Arnold O. Beckman

Although this is a departure from the series of JBC Classics reprinted thus far, we believe it is interesting and appropriate to feature the Beckman DU spectrophotometer, an instrument that for at least three decades contributed greatly to the development of biochemistry.

Beginning in 1940, the first in what became a series of Beckman spectrophotometers was developed at the National Technical Laboratories Company headed by Arnold O. Beckman. This later became the Beckman Instrument Company. Initially, the sole product of the company was the world’s first pH meter, which Beckman had invented, and from which the Beckman empire was launched. Commercial spectrophotometers had been developed some years before, but the two most popular instruments, the Cenco “Spectrophotelometer” and the Coleman Model DM Spectrophotometer, did not have the capabilities to enable work at wavelengths in the ultraviolet.\(^1\)

In 1940, using the amplifier from their pH meter, a glass prism, and a vacuum tube photocell, Beckman and colleagues at National Technologies Laboratories made their first spectrophotometer. (The project was led by Howard H. Cary who later headed the Cary Instrument Company and the development of many very high quality Cary spectrophotometers.) The performance of the first spectrophotometer was not satisfactory, but the design was quickly modified in the Model B version with the replacement of the glass prism with a quartz prism resulting in improved UV capabilities. It was followed with a Model C with improved wavelength resolution in the UV. Three Model C instruments were produced.

The Model D, to now be known as the Model DU, instrument incorporated all of the electronics within the instrument case and featured a new hydrogen lamp with ultraviolet continuum as well as a better monochromator. A diagram of the DU taken from the original instruction manual is shown on the following page. This instrument retained essentially the same design from 1941 until it was discontinued in 1976, a commercial lifetime of 35 years. In 1941, the Model DU had higher resolution and less stray light than other commercial spectrophotometers and was an immediate success. By the end of 1941, 18 Model DU instruments had been sold and by the middle of 1942 another 54. By the time production stopped in 1976, over 30,000 DU and DU-2 (a minor modification of the original DU) spectrophotometers had been sold. They were used in chemistry, biochemistry, and clinical and industrial laboratories. In 1941, the DU cost $723. An advertisement for the Beckman DU Photoelectric Quartz Spectrophotometer from the Arthur H. Thomas Company was published in a 1941 issue of the JBC. The Beckman Model DU Spectrophotometer was considered the Model T of laboratory instruments. It was referred to by Nobel laureate and author of an upcoming JBC Classic, Bruce Merrifield, as “probably the most important instrument ever developed towards the advancement of bioscience.”

Arnold O. Beckman was born in Cullom, Illinois in 1900. He received a B. S. degree in Chemical Engineering from the University of Illinois in 1923 and entered the California Institute of Technology to pursue a Ph.D in chemistry. His work at Cal Tech was interrupted

\(^1\) Information about the history of the Beckman DU Spectrophotometer from unpublished documents kindly provided by the Beckman-Coulter Instrument Company archives. Biographical information for Arnold O. Beckman is from an article published by the Chemical Heritage Foundation entitled “Arnold O. Beckman: The Man and His Instruments” (www.chemheritage.org/explore/Beckman/all.htm).
by a move to New York to be nearer his fiancée, Mabel Meinzer. While in New York, he worked for 2 years at the Bell Laboratories. In 1925, Arnold and Mabel were married and returned to Pasadena where he resumed his Ph.D. studies. After receiving his Ph.D degree in 1928, Beckman became a member of the Cal Tech chemistry faculty. While at Cal Tech, Beckman was a dedicated and popular teacher of freshman chemistry, but his interests were increasingly directed toward applied work and commercial ventures. In 1935, he founded National Technologies Laboratories, where he developed the pH meter as his first successful commercial venture. He was named president of the company in 1939. The company’s greatest success came with the production of the DU spectrophotometer in 1940.

The Beckman Instrument Company grew to become one of the most important producers of a wide range of research and medical instruments. Nearly every biochemistry and clinical laboratory in the world had, or had access to, a Beckman pH meter, a Beckman DU spectrophotometer, a Beckman analytical ultracentrifuge, and other Beckman instruments.

Arnold Beckman amassed a fortune in the scientific instrument business and, through the Arnold and Mabel Beckman Foundation, has been an enormously generous philanthropist. He established five important Beckman Institutes within universities: University of Illinois, California Institute of Technology, City of Hope, University of California at Irvine, and Stanford University. These Institutes are considered the five jewels of Beckman’s philanthropy. Beckman received many honors and awards as an inventor and business and civic leader. He was a recipient of both the National Medal of Technology and the National Medal of Science. He was also awarded the Public Welfare Medal by the National Academy of Sciences in recognition of distinguished contributions in the application of science to the public welfare.

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