Engineers with Heart

Celebrating Two Alumni Who Made Pioneering Contributions to Cardiac Medicine

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William Bennett Kouwenhoven (1906, 1907) and Barouh Berkovits (1956) attended the School of Engineering a half-century apart, but both alumni have gone down in Tandon history for using their engineering know-how to save the lives of countless patients.

William Bennett Kouwenhoven

Photo from the Alan M. Chesney Medical Archives of Johns Hopkins University

William Bennett Kouwenhoven was born in 1886 in Brooklyn, and, like many bright boys in the borough, he headed to what was then known as the Polytechnic Institute. He studied mechanical and electrical engineering and later embarked on a career at Johns Hopkins University, teaching electrical engineering and serving as a longtime dean. In an era well before bioengineering became a watchword, he engaged in collaborative research with Hopkins physician William Henry Howell, who was tapped in 1925 by Consolidated Edison to study the effects of electric shock on the human body. The company had been prompted to fund the research because of the high incidence of death among their linemen, who when shocked on the job were subject to ventricular fibrillation (VF), an irregular rhythm in which the heart becomes unable to pump blood and fails.

Early closed-chest defibrillator. Photo from the Alan M. Chesney Medical Archives of Johns Hopkins University

Kouwenhoven began by observing the effects of DC and AC shocks on the heart, noting that low-voltage shocks cause VF, while higher-voltage shocks cause the lungs to shut down as well. He discovered, however, that administering another jolt of electricity restored sinus rhythm and regular contractions, making the fibrillating heart beat normally again.

In 1950 he helped develop the first closed-chest cardiac “defibrillator,” which delivered AC current to the heart with two main electrodes. In the process of testing the unit, Kouwenhoven discovered that a patient’s blood pressure rose slightly when the electrodes were applied, even before any current was triggered. That finding led him to speculate that pressing rhythmically on the chest could cause the blood to

circulate, leading to the development of manual CPR. In 1957 his defibrillator, which had by then undergone numerous refinements, was used in an operating room at Hopkins.

In a dramatic turn of events, three years later, it was used for the first time in the emergency room, after a patient arrived in the middle of the night mistakenly complaining of indigestion and suddenly collapsed. The physician on duty dashed up 11 flights to Kouwenhoven's lab and wheeled the 200-pound machine to the ER, saving the life of his 42-year-old patient and marking the world's first emergency defibrillation for cardiac arrest. Kouwenhoven went on to develop a more portable and affordable model, which, at just 45 pounds and 15 inches high, could be more easily used out in the field.

In 1961 Kouwenhoven (who worked almost up until the time of his death, in 1975) was awarded the Edison Medal "for his inspiring leadership in education, for his contributions in the fields of electrical insulation, electrical measurements, and electrical science applied to medicine, and especially for his investigations of the effects of electricity on the human body with the successful development of countershock for the cure of fibrillation of the heart." An IEEE Fellow, he was also the recipient of one of the medical profession's highest honors, the Albert Lasker Medical Research Award.

Barouh Berkovits

Photo from the Poly Archives & Special Collections of NYU

A native of Czechoslovakia, Barouh Berkovits (1926-2012) had seen his parents and sister killed at Auschwitz, and he immigrated — first to Israel and then to the United States — to forge a new life for himself. He graduated from the Polytechnic Institute in 1956, the year before Kouwenhoven's AC defibrillator was first used on a human patient. Upon graduating, he was hired by the American Optical Corporation, which was then manufacturing the AC defibrillators. Named director of cardiovascular research, Berkovits set out to remediate the shortcomings of the existing model and hit upon the idea that using DC current would be safer and more effective. Working with a fellow researcher, Bernard Lown, he began a series of experiments that culminated in a 1962 patent for a DC defibrillator that quickly became the gold-standard technology for cardiac resuscitation.

Berkovits, who later accepted a position on the faculty of his alma mater, was also instrumental in the development of the "demand pacemaker," which monitors heart rhythm and sends electrical pulses only if the heart is beating too slow or misses a beat.

Medical historians point to Berkovits' work as the impetus for the modern hospital cardiac-care unit, and in 1982 he received the Distinguished Scientist Award from the Heart Rhythm Society.

Berkovits and Kouwenhoven exemplify what has long been the mission of our school, through many decades and name changes: to develop technology that can be used for the good of society. Their work is a testament to the power of engineering to change — and even save — lives.