

Wilson Greatbatch (1919–2011)

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Wilson Greatbatch was born September 6, 1919, in Buffalo, New York State as the only child of Warren Greatbatch a construction contractor and Charlotte Greatbatch who worked as a secretary. He died on September 27, 2011 at the age of 92. Greatbatch trained as an electrical engineer at Cornell University and the University of Buffalo where he then taught engineering between 1952 and 1957. While building an oscillator to record heart sounds, Greatbatch made a fortuitous discovery. He grabbed the wrong resistor from a box and plugged it into the circuit he was making. The unit gave off a startlingly familiar, uneven electrical pulse. The circuit pulsed for 1.8 ms, stopped for 1 s and the sequence was then repeated. This serendipitous moment changed history. Greatbatch described the incident in his 2000 memoir “The Making of the Pacemaker” by saying “I stared at the thing in disbelief and then realized that this was exactly what was needed to drive a heart.” This was an example of Pasteur’s observation that “chance favors the prepared mind.”

On May 7, 1958, Greatbatch brought what would become the world’s first implantable cardiac pacemaker, made with two Texas Instrument transistors, to William M. Chardack who was chief of surgery at the Buffalo Veterans’ Hospital. There, Chardack and another surgeon, Andrew Gage, exposed the heart of a dog on which two pacemaker wires were applied. The pacemaker took control of the heartbeat to the utter amazement of the investigators. The device which was wrapped in electric tape lasted 4 hours. On this experience, Greatbatch scribbled in his lab diary “I seriously doubt if anything I ever do will ever give me the elation I felt that day when my own two cubic inch piece of electronic design controlled a living heart.” [1].

Greatbatch retreated to his backyard workshop, a barn heated by a wood-burning stove. There, he made 50 pacemakers by hand. These devices were built with proper casing. This work would eventually launch Medtronic presently the biggest



Figure 1. The “bow tie” trio. Left, William Chardack, Andrew Gage, and Wilson Greatbatch at the bedside of one of the first recipients of their pacemaker.

medical device company in the world. The first successful implantation of the Greatbatch pacemaker took place in April 1960 by Chardack at the Buffalo Veterans’ Affairs Hospital, after extensive animal testing (Fig. 1) [2, 3]. The 77-year-old patient lived for 18 months after the device was implanted. Another member of the initial group lived for 30 years. Compared to the original Swedish pacemaker, Greatbatch’s pacemaker was a huge leap forward because it incorporated smaller nonrechargeable mercury-zinc batteries making the device truly implantable. During 1960 Chardack and his associates implanted pacemakers in 10 patients, most over 60 years of age. Two were children. All ten had complete heart block, so that without pacemakers they had perhaps a 50-percent chance of living more than a year. Forty of Greatbatch’s units would go into animals. Greatbatch had opened the door for pacemaker industry. Transvenous implantation had to wait until 1962.

Greatbatch was not the first to come up with a surgically implanted pacemaker. That happened in 1958 in Sweden, using a device designed by Rune Elmqvist. Ake Senning attempted the first human

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pacemaker implantation late in 1958. The unit failed after 3 hours. A second unit worked for 8 days before failing. An improved version of the Elmqvist pacemaker was implanted in February 1960 in Montevideo, Uruguay and that device functioned successfully for 9 months until the patient died [4]. The Swedish pacemakers had rechargeable batteries. On this basis, Greatbatch can rightfully be considered the inventor of the first practical self-contained implantable pacemaker.

Greatbatch filed for a U.S. patent on the cardiac pacemaker July 22, 1960. In 1961, he sold the rights to produce and market his “implantable pulse generator” to Minneapolis-based Medtronic Inc. My first exposure to pacing during my cardiology training actually involved Medtronic pacemakers with a prominent “Chardack-Greatbatch Pulse Generator” label on the device themselves.

Soon the battery became the biggest problem. The Greatbatch pacemaker featured a mercury-zinc battery that lasted about two years. Greatbatch grew increasingly frustrated with battery technology and the limitations it imposed. The mercury-zinc battery was cast in epoxy which was porous to the discharge of battery released hydrogen. This allowed fluid leaks into the pacemaker at times causing electrical shorting and premature failure. Indeed, Greatbatch referred to these mercury-zinc pacemakers as “running under water” because water vapor is a gas. In the early 70s, Greatbatch left the world of pacemakers and began manufacturing lithium batteries. He acquired rights to a lithium-iodide design invented in 1968 by researchers in a small Baltimore company that could not find a commercial application for their product. In 1970 Greatbatch founded a company to manufacture batteries for the implantable pacemaker. He devised a more durable lithium-iodide cell that became the industry standard. By 1972 Greatbatch had re-engineered the battery into a compact sealed package that could be implanted in the body for a decade or more. In this way, Greatbatch became the first to introduce the lithium-iodide battery into a pacemaker a step that revolutionized cardiac pacing. The battery had no gas emission and could be hermetically sealed thereby increasing device reliability. The new battery had a life of 10 years compared to only 2 years of the old mercury-zinc battery; this further greatly advanced the use and acceptance of implantable pacemakers. The new batteries became the workhorse and the gold standard for many medical devices in addition to pacemakers. The new company became a major producer of pacemaker batteries and continues to manufacture them to this day.

Inventing was Greatbatch’s lifelong passion and several sources indicate he had over 300 patents to his name. He was awarded ScD degrees from several universities. In 1983, the implantable pacemaker was named one of the 10 greatest engineering contributions to society during the past 50 years by the US National Society of Professional Engineers. In 1984, Greatbatch received the Distinguished Scientist Award from the Heart Rhythm Society (formerly NASPE). For his contributions to science, Greatbatch received the National Technology Medal in 1990 from President George H.W. Bush. In 1996 Greatbatch was awarded the Lemelson-MIT Prize for lifetime achievement. In 1998 he was admitted to the National Inventors’ Hall of Fame in Akron, Ohio following in the footsteps of his hero, inventor Thomas Edison. In 2001 he was granted the highest honor from the National Academy of Engineering, shared with Earl Bakken, who invented the external pacemaker and founded Medtronic. Greatbatch is half of the namesake for the prestigious AAMI Foundation Laufman-Greatbatch Prize, which is given annually to an individual or group who made unique and significant contributions to the advancement of medical instrumentation and patient safety.

Greatbatch described himself as a “humble tinkerer.” He was indeed a humble and wonderful human being. He was gentle and unassuming. He was very approachable and always available to the medical community to answer technical questions. To many of his friends and admirers, he had a “heart of gold.” Words cannot adequately describe the impact that Greatbatch had on the lives of countless people. He was an outstanding personality of our time. A great man has left us. Wilson Greatbatch is survived by his daughter and his three sons. His wife Eleanor the maker of his trademark bow ties died in January. One son predeceased him.

Disclosures

The author does not report any conflict of interest regarding this work.

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