

In Memoriam

A Tribute to Istvan Babotai, PhD

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In 1956, at the age of 17, Istvan Babotai fled Hungary, became an electrical engineer and ultimately a pioneering figure of cardiac pacing in Switzerland. His 23-year long collaboration with Professor Åke Senning marked a transformative period in the fields of the heart-lung machine and in cardiac pacing. His commitment and passion for biomedical engineering inspired Swiss electrophysiologists.

Upon his arrival in Switzerland, he swiftly learned German, passed the entry exam to the ETH and obtained his engineering degree. After graduating in 1961, he was hired by Åke Senning, the newly appointed director of the Surgery Department at the University Hospital of Zürich. At this time, the mortality of patients operated on a heart-lung machine exceeded 50%. Initially, Istvan's efforts were focused on optimizing the heart-lung machine. Later, the first membrane oxygenators emerged and in collaboration with Prof. Marko Turina, Istvan was able to build a heart-lung machine with a small filling volume suitable for infants and toddlers.

In 1958, Professor Åke Senning implanted the first pacemaker in Stockholm. It necessitated open heart surgery and the large epicardial surface electrodes had very high pacing thresholds. Because of these obstacles, Senning implanted only ten pacemakers in Zurich during 1961 and 1962. The situation changed fundamentally with the introduction of transvenous endocardial leads in 1963. The pacing thresholds were acceptable, thoracotomy was avoided and the pacemaker could be implanted with local anesthesia. In 1968, Istvan manufactured 70 units of the fixed-rate VOO pacemaker ("Zurich Model"). The electronic circuits and three mercury batteries were placed in a row within a gold-plated metal casing and sealed with epoxy resin on the front side.

Implanting pacemakers in children posed a particular challenge. One day, Istvan was approached by Professor Senning with the urgent request to provide him with the smallest possible pacemaker for a newborn. Istvan managed to build two pacemakers (one as a backup) within four days. The design was improvised and simple. The result was a tiny pacemaker (4 cm in diameter, 2.3 cm in height) which subsequently was successfully implanted. This

example illustrates the initial pioneering spirit in the emerging field of cardiac pacing.

The first transvenous endocardial leads lacked a guiding wire and without an anchoring mechanism, the dislocation rate remained high. It wasn't until the early 1970s, that leads with anchoring mechanisms were developed. Istvan's work resulted in the creation of the so-called Helifix electrode in 1975. The electrode head consisted of a front-closed double spiral of 0.5 mm thick platinum-iridium wire and could be screwed between the trabeculae of the right ventricle. With the introduction of dual chamber pacemakers in the late 1970s, the Helifix lead could also be successfully positioned in the right atrium and it remained the standard lead in both atrium and ventricle placement at the University Hospital of Zürich until 1987.

Together with the outpatient clinic, Istvan established a pacemaker clinic to follow the technical performance of the implanted devices in 1969. Oscilloscopic analysis of the pulse duration, amplitude and the pacing interval of the pacemaker provided information about changes in battery voltage and lead impedance. Due to the relatively short operating lifespan of pacemakers (2–2.5 years), follow-ups were conducted every six months in the first year, every three months in the second and monthly after two years.

In the early 1980s, in an increasingly competitive environment, Istvan participated in a large project to create an artificial heart, funded by the Swiss National Foundation. After years of development, the artificial heart was successfully tested for 24 hours in a calf but never came on the market.

When industrial production of pacemakers and heart-lung machines emerged in the late 1970s, Istvan shifted his focus, but his commitment to the medical device field remained unwavering. As a founder of the "Pacemaker Working Group" of the Swiss Society of Cardiology, Istvan coordinated the implantation centers in Switzerland, communicated technical issues with devices and liaised with the industry. Education and training in the field of pacemaker therapy, as well as quality promotion were additional central tasks of the working group. The working group was



Dr Istvan Babotai at the University Hospital Zurich in the 60's.

commissioned by the Swiss Society of Cardiology to establish a national registry for device implantation and ablation procedures (SwissEPnet). In 2003, Istvan established the Swiss Rhythmology Foundation with the objectives to advance research in pacing and electrophysiology, support research projects, promote education and training of physicians, and promote quality insurance in the field.

Istvan's professional life was marked by innovation, curiosity, dedication and commitment to advancing cardiac healthcare. His journey from a teenager in Hungary to his integral and indispensable role in the quickly developing field of cardiac pacing in Switzerland, is a prime example of the creative power of passion, curiosity and desire to improve lives.

Our esteemed friend and colleague, Dr Istvan Babotai, PhD, passed away on July 3, 2023, at the age of 83, leaving behind an indelible legacy. He will be missed by the Swiss cardiac pacing community.

Acknowledgement

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