Manfried Hoke

1933–2006

Those of us who had the pleasure of being invited for dinner to Marc Hoke's home will never forget the passion with which he prepared exquisite meals that would have done a gourmet chef credit. He exhibited the same passion for perfection throughout his scientific career. In the last decades of his life, he was undoubtedly a major force in audiology, enjoying a worldwide reputation. On June 26, 2006 he died at the age of 72.

The son of a teacher, Manfried Hoke was born September 6, 1933 in Meissen, a town on the river Elbe in the state of Saxonia in southeastern Germany. After World War II, Meissen was behind the Iron Curtain and Manfried's situation was aggravated by the premature loss of his father. In 1952, he took his school-leaving exam, and after a short detour into physics he began studying medicine at the University of Jena. In 1955, he crossed the Iron Curtain and continued his medical education at the University of Hamburg, where he passed his final exams in 1958 and stayed another five years. While working as a research assistant at the Pharmacological Institute, he received his doctoral degree in 1960. After a medical internship he got his license to practice medicine in 1962.

The following year saw some major changes. Hoke not only moved to Münster, where he would set up home for the rest of his life, but he also switched from pharmacology to physiology, where he became particularly interested in the peripheral auditory system. Until 1966, he worked in the Physiological Institute of Münster University, and then he joined the ear, nose and throat clinic, without changing his scientific focus. From today's point of view, the most interesting paper of these early years is

probably a case report from 1970 by Kumpf and Hoke, which describes a constant tone emanating from the ear.¹ Almost one decade later, this phenomenon became known as spontaneous otoacoustic emission. However, Hoke was already heading in a different direction at that time: auditory-evoked potentials.

¹ Arch Klin Exp Ohren Nasen Kehlkopfheilkd 1970;196:243–247.

In 1970, the thalidomide tragedy led to the establishment of a Special Research Area funded by the German Research Foundation (Deutsche Forschungsgemeinschaft). Hoke became deputy chairman and later chairman. Research was devoted to teratology and rehabilitation of persons with multiple handicaps. The topic of Hoke's own project was objective audiometry. First, he concentrated on cochlear microphonics, developing a Fourier-transform-based technique that allowed simultaneous cochlear microphonics recordings at 9 frequencies. A key issue of this technique is synchronism between stimulation and data recording, which was accomplished using the same computer for both tasks. In some respect, his technique anticipated ideas that were developed many years later for amplitude-modulation-following responses. In 1973, Hoke was awarded the postdoctoral lecture qualification (*venia legendi*) for this research. He also became a computer expert in these years, able to program his Honeywell DDP-516 in Assembler and to undertake simple hardware repairs himself. Such skills were valuable at that time, because computer resources were extremely precious. Having only 8 kB of memory (including buffers for stimulus and data) meant that programs had to be highly optimized. In 1971, he got 16 kB of additional memory, costing nearly three times the annual salary of a scientist! I suppose that Hoke would have been interested in the fact that an emulator of the old Honeywell computer is being developed now, which might allow running some of his old programs in a Linux environment. Heaven knows how much memory it requires.

As a scientist who continuously strived for a deep understanding of physiological principles, Hoke noticed problems with cochlear-microphonic recording in man, and he frankly expressed his concern in an article that appeared in 1976. Two other types of potentials came into focus then: the compound action potential of the auditory nerve and brainstem auditory-evoked potentials. Hoke, appointed professor in 1977, also recognized the importance of signal processing and modeling for his field of research. His goal, however, remained the same: to obtain frequency- and location-specific responses from the auditory system. To achieve this goal, Hoke and his team followed two main strategies in the subsequent years. First, frequency-specific stimulation techniques were developed. Second, attempts to enhance the frequency specificity *after* the measurements were made, by post-processing the recorded data. Deconvolution techniques were developed for that purpose, which aimed to reverse the superposition of responses from different lo-

cations. In addition, signal processing techniques were devised, which helped to improve the signal-to-noise ratio of the recorded data.

Another turning point in Hoke's scientific career occurred around 1984, although it only became evident in retrospect. Encouraged by promising publications concerning auditory-evoked magnetic fields, Hoke acquired a one-channel neuromagnetometer. While it was relatively clear that a magnetic field measurement at a single location would not offer a significant advantage compared to a one-channel electrical recording, recordings from many different locations promised an exciting new window on the brain. Provided that an observed magnetic field arises from a single circumscribed source, this source can be precisely localized. Initially, the limitations imposed by the assumption were underestimated, and it appeared feasible to observe, for example, tonotopy in auditory cortex with this technique. The enthusiasm of the researchers, in combination with their overoptimism, gave an enormous impetus which fostered the development of magnetoencephalography, and Hoke became one of the trailblazers.

In 1986, his research division turned into the independent Institute of Experimental Audiology, and he was appointed director. Magnetoencephalography research attracted increasing attention in the young institute, although measurements with a one-channel instrument were cumbersome: to obtain the spatial distribution of the magnetic field, the subject's head had to be scanned point by point in subsequent measurements, which took several days per subject. Nevertheless, the results won international recognition, which provided the momentum for Hoke's next venture establishing a clinical research unit for biomagnetism and biosignal analysis. In 1991, a 37-channel neuromagnetometer system was installed in a new building that was exclusively reserved for biomagnetism research. In the same year, Hoke hosted the 8th International Conference on Biomagnetism. The institute now had one of the best instruments in the world and it attracted visiting scientists from many countries. In the course of this development, the institute's main focus changed from audiology to neuroimaging. In 1994 Hoke organized another world congress, the 5th International Conference of the International Society for Brain Electromagnetic Topography.

While the focus of his institute changed, Hoke himself never turned his back on audiology. On the contrary: in 1995 he became the founding Editor-in-Chief of *Audiology & Neuro-Otology*, and in 1996 he initiated the forma-

tion of the German Society of Audiology and became the first president. He fulfilled these two tasks for many years, even after his retirement in 1998.

Manfried Hoke received prestigious awards. In 1987, he received the Ludwig-Haymann Prize of the German Society of Otolaryngology for his research on maturation of the central auditory pathway and tonotopic mapping in auditory cortex. In the same year, he received the Helmholtz Prize for his work on brainstem auditory-evoked fields. In 1990, he became an honorary member

of the Italian Society of Audiology. He was awarded his last honor only a few weeks before his death, when severe illness had already left its mark on him: the managing committee of the German Society of Audiology unanimously decided to appoint him as an honorary member. The official ceremony was scheduled for the next annual meeting of the society, jointly organized with the European Federation of Audiology Societies. Unfortunately, Marc was not destined to celebrate this event.

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