

## GUEST EDITORIAL

### Reflections on a half century as we approach the millennium

**Robert W. Mann, Sc.D.**

*Whitaker Professor Emeritus,*

*Biomedical Engineering, Massachusetts Institute of Technology*

January 1999, with but one year to go to 2000, is a good time to reflect on rehabilitation engineering progress in the second half of the 20th Century, this from a personal perspective, in particular identifying the individuals who influenced me.

I was introduced to rehabilitation research by the late John Kenneth Dupress, blinded and maimed in World War II, thanks to a German grenade in the Battle of the Bulge and then Nazi medical experimentation. Benefiting by the same GI Bill that paid for my MIT education (his at Princeton), John in the late 50s was dedicated to recruiting scientists and engineers to work on sensory aids for the blind. After my post-graduate decade of missile Research and Development at MIT, John convinced me, my faculty associate Dwight Baumann, and my MIT classmate Lindsay Russell, that the then-novel digital computer could be trained to translate English text into Braille (and so it came to be), that mobility beyond the long cane and guide dog could be achieved (we have still a way to go), and there were many other tasks and roles engineers and scientists could make accessible to blind and visually impaired persons (some accomplished, many more yet to be achieved).

In an indirect fashion, Norbert Wiener, MIT mathematician and coiner of "*cybernetics*," by speculating on the feasibility of brain control of a prosthetic arm, and then becoming himself a patient with a broken hip, set the stage for my research that begot the "Boston Arm," an early EMG-controlled elbow, the first to demonstrate "natural" control of the limb by detecting muscle signals in the residual



**Professor Mann** observing the pressure-instrumented hip prosthesis entering a human acetabulum in the MIT Hip Simulator, prior to acquiring *in vivo* data in human experiments:

Hodge WA, Fijan RS, Carlson KL, Burgess RG, Harris WH, Mann RW.

Contact pressures in the human hip joint measured *in vivo*. Proceedings of the National Academy of Sciences, USA, May 1986;2879-83.

Macirowski T, Tepic S, Mann RW.

Cartilage stresses in the human hip joint. J Biomech Eng 1994;116:10-8.

limb which, prior to amputation, actuated the joint. Subsequently, one of my graduate students, Stephen C. Jacobsen, PhD, went on to develop, among other rehab and medical devices, the Utah Arm. I recently had the opportunity, on the 100th anniversary of Professor Wiener's birth, to comment on the extent to which Wiener's prognostications had been realized and to identify ongoing research on behalf of disabled persons - some of which will not be realized until well into the upcoming century.\*

Much effort in those early years, beyond actual R&D, went into attempts to organize a coherent and effective national rehabilitation research program. Many individuals contributed to this, but I especially think of the late Leon D. Harmon, then at the Bell Telephone Laboratories, and James B. Reswick, Sc.D. Jim and I were colleagues in that same missile lab at MIT. He transferred to Case Institute of Technology, where he inaugurated a rehab R&D program that became one of the early Rehabilitation Engineering Research Centers, then moved to California where he headed up the Rancho Los Amigos REC, returned East to Washington as the associate of Margaret Giannini, MD, in the then NIHR, moved with her to the VARR&D program, and thence back to NIDRR. No one has contributed more administratively, as well as technically, to the rehabilitation R&D field as we know it today than has Jim.

Situated as I was throughout my career in the rich scientific and engineering environment of MIT, I benefited from brilliant and committed faculty and staff colleagues in the several labs I founded. Many of these individuals have moved on to other universities where they have mounted their own programs or have assumed responsible positions in rehabilitation organizations. I think of Michael J. Rosen, PhD, now Director of the Rehabilitation Engineering Service,

National Rehabilitation Hospital, Washington, DC, and scientific consultant to this *Journal*.

But it was the unending supply of talented undergraduate and graduate students, eager to apply their newly acquired knowledge to the benefit of disabled persons, that constituted the real bulwark of MIT's program. How nice to have this editorial greet one of these, the new Director of the United States Department of Veteran Affairs Rehabilitation Research and Development program. The introduction of Mindy Lipson Aisen, MD, to rehab as an MIT freshman was to devise a "toy" that intrigued the disabled child while simultaneously providing rehabilitation training. Her "magic light pen" served both tasks admirably!

Our collective half-century progress on behalf of disabled persons has been much broader than that contributed by rehabilitation science and engineering alone. When I started my blindness-oriented research I was baffled and disappointed to learn of the competitiveness and frictions between groups afflicted with different losses; for example, those who were deaf saw no common purpose with those who were blind. How far society at large has come is exemplified by the U.S. Congress' passage of the Americans with Disabilities Act. It has been a promising half-century for the disabled!

*Robert W. Mann, ScD*

**This guest editorial is an invited opinion.  
The Editor**

\*Mann, RW, "Sensory and Motor Protheses in the Aftermath of Wiener," Norbert Wiener Centenary Congress, Proceedings of Symposia in Applied Mathematics, Providence, RI: American Mathematical Society; 1997:52:401-39.