MEMORIAL RESOLUTION OF THE FACULTY OF THE UNIVERSITY OF WISCONSIN-MADISON

ON THE DEATH OF PROFESSOR PAUL BACH-Y-RITA

Paul Bach-y-Rita, M.D., professor of rehabilitation medicine and biomedical engineering, died at his home on Nov. 20, 2006. He was born on April 4, 1934 in New York City to Anne Hyman and Pedro (Pere) Bach-y-Rita and graduated from the Bronx High School of Science at age 15, and from Mexico City College (now the University of the Americas in Puebla) at age 17. He received his M.D. in 1959 from the Universidad Nacional Autónoma de México and became the first and only physician in Tilzapotla, Morelos, Mexico, a rural village without roads or electricity. Decades later, Paul could relate fascinating stories about delivering babies under unimaginable circumstances, negotiating a cooperative healthcare pact with the village shaman, and having to check regularly his thatched hut for scorpions. He loved the clinical and social challenges, and understood that he was providing an invaluable service to this impoverished community. Even then, however, he recognized the limits of his knowledge and knew that he was destined for a career in medical research.

Following post-doctoral work at the University of California, Los Angeles, the Institute Marey, Centre National de la Recherche Scientifique in Paris, and the Universität Freiburg in Breisgau, West Germany, Paul became a senior research member of the Smith-Kettlewell Institute of Visual Sciences, Institute of Medical Sciences Pacific Medical Center in San Francisco in 1963 and its associate director in 1968. It was during his years at Smith-Kettlewell that he and his colleagues devised the first successful tactile vision substitution system. Developed in their spare time and using surplus equipment, it was a feat which earned them a paper in the journal *Nature* in 1969. His goal in this research was not only to aid persons with visual disabilities, but also to demonstrate the capacity of the human brain to recover function by reorganizing its activity following injury and to develop a paradigm for that process. When he originally proposed this idea in the early 1960's, along with one of its putative mechanisms, non-synaptic diffusion neurotransmission of information in the brain, it was largely ignored or dismissed as too fantastic. Now it is an area of vigorous neuroscience research around the world.

His father's dramatic and medically-inexplicable recovery from a major stroke, largely in response to an innovative rehabilitation program designed by his brother, Dr. George Bach-y-Rita, triggered a four-decade fascination with the brain's astonishing ability to recover function when aggressively retrained following injury. Paul abandoned his promising career in eye movement research and completed a residency in rehabilitation medicine at the Stanford Santa Clara Medical School in 1979. He then became professor and vice chairman of the Department of Physical Medicine and Rehabilitation, and professor of human physiology in the School of Medicine at University of California, Davis; also chief of the Rehabilitation Medicine Service at the Martinez, CA Veteran's Administration Medical Center. In 1983 Paul moved to the University of Wisconsin-Madison to become professor (chair 1983–1988) of the Department of Rehabilitation Medicine, and founded the Neuromuscular Retraining Clinic (NMRC) to incorporate the innovative, intensive, and highly effective program he had developed from his clinical research on recovery from brain and spinal cord trauma. He also reestablished his research program in tactile vision and other forms of sensory substitution at that time.

The culmination of Paul's sensory substitution research was realized in 1997 when he and his colleagues demonstrated the capacity of the tongue to discern patterns of electrical stimulation, a concept he had proposed years earlier but had garnered little interest. He patented this invention through the Wisconsin Alumni Research Foundation and subsequently founded Wicab, Inc., named after his wife Esther Wicab-Gutierrez, to commercialize the technology. Wicab's first product, a vestibular (balance) sensory substitution device is, as of the date of this writing, in clinical trials and is the only effective treatment for

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bilateral vestibular dysfunction, which results in disabling balance and visual disturbances and affects tens of thousands of people in the U.S. alone. Over one hundred other potential applications of the electrotactile tongue display have been identified, and several are being actively pursued, including visual and auditory sensory substitution, touch feedback for prosthetic limbs, and communications systems for military and civilian personnel operating in hazardous environments. Leading academician-industrialist John Caulfield described the tongue human-machine interface (for which Paul coined the "BrainPort" trademark) as "a brilliant, world-changing invention."

As a scientist-clinician, Paul authored or co-authored 10 books, over 70 book chapters, and approximately 150 journal and conference papers. Two books of particular note are *Brain Mechanisms in Sensory Substitution* (New York: Academic, 1972) and *Nonsynaptic Diffusion Neurotransmission and Late Brain Reorganization* (New York: Demos, 1995). The common theme of these works is his unshakable conviction that it is the innate adaptability, or plasticity, of the human brain that underlies the possibilities for human perceptual and functional capability, and recovery even many years after injury. This is best summarized in a few of Paul's favorite and still intellectually provocative dictums:

"You see with your brain, not with your eyes."
"The nerve impulses coming from the eye are no different than those from the big toe."
"Just give the brain the information and it will figure it out."

Fluent in Spanish, French, and Italian, Paul was an avid world traveler, initiating collaborations and guiding research projects in Mexico, France, Germany, Spain, Japan, and Sweden. Abroad as well as at home in Madison, he effortlessly transcended administrative, geo-political, cultural, and language boundaries for the benefit of neuroscience.

Paul's passion for the evolution of neuroscience extended to fostering the development of the next generation of researchers. Without fanfare, he astutely mentored aspiring junior colleagues, encouraging them to think expansively — beyond departmental, institutional, national, and, especially, conceptual boundaries. He embraced rigorous scientific debate and continually encouraged both the professional development and intellectual independence of his protégés. Those who have studied Paul Bach-y-Rita's remarkable work have greatly benefited from his ability to think well beyond the horizon. His imagination and creativity will continue to be realized and appreciated for many years to come.

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