Dreamer of the Art of the Possible

The year was 1966, and I had just arrived from the Massachusetts Institute of Technology to enroll in the Medical School at Stanford, with a goal of pursuing both an M.D. and a Ph.D. degree in electrical engineering (EE). The Stanford campus was literally ablaze in some not-so-peaceful antiwar demonstrations, making attending classes somewhat difficult.

In 1968, having passed the EE Ph.D. degree qualifying exams, I was searching for a thesis project in an area that would now be considered bioengineering, but the field didn't exist at the time. Through one of the medical school faculty members, I was introduced to Jim Meindl, who had arrived at Stanford the previous year and recently received a National Institutes of Health grant to construct implantable IC to relay information from Doppler ultrasonic flowmeters placed in research animals that had undergone heart transplantation.

When I first met Prof. Meindl, I was shocked—Jim stood ramrod straight with a flat-top haircut, popularized in the 1950s, which was his signature identifier throughout his career. In the 1960s and early 1970s, sporting a flat-top haircut was like waving red flag in front of an antiwar demonstrator! I wondered how Jim would survive the increasingly dangerous demonstrations that were just getting underway at Stanford, including ones that ultimately forced Stanford to close the classified research being conducted in the engineering research labs in the heart of the EE Department where Jim's office was located.

Despite first appearances, I was delighted when Jim agreed to take me on as one of his early Stanford Ph.D. students, starting a long-term relationship of more than 35 years as a mentor, colleague, and friend. Despite his rigid appearance, in reality, Jim was exceedingly warm, kind, and flexible. The parties that Jim and his wife, Freddie, held at their home provided lots of good food and, more importantly, warm support to his students.

While I thought my project might involve working on IC technology, it became clear very early in the project that these Doppler ultrasonic flowmeters didn't function reliably, making them unsuitable for chronic monitoring of blood flow. Some people tried to redesign the monitors, but the performance paradoxically got worse.

Prof. Meindl asked me to take on an initial project to determine why these devices provided unreliable estimates of blood flow and how to design the optimal flowmeters. This first "project" morphed into my dissertation—the development of the theory of measuring blood flow using ultrasound. Over the next two years, it became obvious that this was a problem more related to radar and statistical communication theory than IC technology.

Jim enlisted another faculty member, Prof. Joseph Goodman, an expert in advanced optics, to be my second reader. Eventually, we developed algorithms for the optimal estimation of blood flow with ultrasound that provided substantial performance improvements. As the field of medical ultrasonic imaging was just beginning, these algorithms ultimately became the basis for the commercial systems providing colorized Doppler maps that are now incorporated into virtually all medical ultrasonic imaging machines.

Jim was incredibly well organized, supervising a stable of students working in the IC laboratory, many of whom went on to become professors, inventors, and/or CEOs of successful start-up companies. I would characterize Jim as a "dreamer of the art of the possible," with incredible focus to work on the baby steps that would eventually lead to big breakthroughs. No problem was too difficult to undertake. With respect to ultrasound, Jim and his students developed many of the applications of ultrasound for medical imaging (and blood flow estimation) years in advance of when the IC technology was sophisticated enough to bring these ideas to routine use in hospitals and clinics.

—William R. Brody

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About the Author

William R. Brody became a professor of radiology and electrical engineering (by courtesy) at Stanford, followed by the position of radiologist-in-chief at the Johns Hopkins Hospital. From 1996 to 2009 he served as president of Johns Hopkins University and from 2009 to 2016 as president of the Salk Institute.

Child-Like Curiosity and Enthusiasm

Jim Meindl was an academic who wanted to be sure his innovations became practical and useful for others. I was new on the faculty of the Stanford School of Medicine, across the street from the Meindl Lab. We were some of the first in the United States to use ultrasound as a noninvasive sensor for the motion of heart walls and valves. The recording was done on a strip chart, with the distance of the multiple reflected signals plotted against time—essentially, "squiggles" on paper that had to be interpreted.

Jim learned of the possibility of making actual 2D images of the cardiac anatomy and thought he could use his technology innovations to improve what we were doing in the Medical Center. He and his group went on to measure blood flow noninvasively as well. I was completely impressed by his enthusiasm to go on beyond the publication of academic papers and make imaging systems that could improve the recognition of cardiac disease and improve patient care. He immersed himself in understanding the challenges of noninvasive imaging inside the body. "Echocardiography" was new, and he had an almost child-like curiosity and enthusiasm to learn about what I was doing.

Jim was one of the first people I met who understood the value of multidisciplinary collaboration to solve important problems. He found what was needed in other disciplines, like medicine, and applied his wide-ranging knowledge to find solutions to those needs. Jim was a famous professor, but he treated this very young assistant professor as an equal. Like many others, I am very fortunate to have known him.

—Richard L. Popp

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About the Author

Richard L. Popp is a professor of medicine (emeritus) at Stanford University and teaches in the Stanford Biodesign Program. His research has focused on developing all forms of ultrasound. Dr. Popp was president of the American College of Cardiology, the American Society of Echocardiography, and the Association of University Cardiologists and chair of the American Board of Internal Medicine's Cardiovascular Diseases Subspecialty Board.