

OUR SURGICAL HERITAGE

In Memoriam: Randall B. Griep (1940-2022): Master Surgeon, Innovator, Scientist, Teacher, and Sailor

Steven L. Lansman, MD, PhD,¹ and D. Craig Miller, MD²

Dr Randall B. Griep's career spanned the founding age of cardiovascular and thoracic aortic surgery, the era he called "the golden age of cardiac surgery." He made groundbreaking contributions in cardiac transplantation while at Stanford and in the surgical technique and the methods of cerebral and spinal cord protection for thoracic and thoracoabdominal aortic surgery throughout his years as chairman of cardiothoracic surgery at The Mount Sinai Medical Center in New York. His commitment to honesty and his personal ethic and stature served as a role model for a generation of trainees, many of whom went on to leadership roles in cardiovascular surgery.

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Our specialty lost an innovative surgeon and an uncommon man with the passing of Dr Randall B. Griep on September 8, 2022, at the age of 82 (Figure 1).

Dr Griep was born in Minnesota, raised in Monterey County, and attended the California Institute of Technology. He received his medical degree from the Stanford University School of Medicine in 1967, where he first met heart transplant pioneer Dr Norman E. Shumway, who inspired him to embark on a lifelong career in cardiac surgery. Dr Griep completed a medical internship at Bellevue Hospital in New York. There he met his future wife, Eva Botstein, then a New York University medical student who subsequently trained in pediatric cardiology; they were partners and scientific collaborators for life (Figure 2).

He returned to Stanford in 1968 for his general and cardiovascular surgical residency, training under Dr Shumway. His residency was unusual for that era, because from the outset, Dr Shumway had him focused on cardiovascular surgery rotations with sporadically interspersed general surgical rotations. He was an attending on the Cardiovascular Surgery Service before completing his chief residency in general surgery.

These were exciting times in cardiac surgery and at Stanford in particular, as Dr Shumway had performed his first heart transplant, the world's fourth, on January 6, 1968. Dr Griep joined that service several months later. His talent and his intellect were highly evident, and he

shared major responsibility with Dr Edward B. Stinson for the intraoperative and postoperative care of transplant patients. He performed his first heart transplant on January 1, 1970, and for many years, that patient was the longest heart transplant survivor, surviving 26 years. From 1970 to 1972, Dr Griep assumed major responsibility for the clinical transplant program at Stanford. These were the formative years of cardiac transplantation, when only several institutions worldwide were actively developing cardiac transplant programs, and Dr Griep's personal experience arguably constituted most of the world's collective experience.

During this period, Dr Griep was the first author of a number of key publications that helped establish heart transplantation as a viable, reliable clinical option. Among many, these included the first paper on the diagnosis and treatment of acute human cardiac allograft rejection, management of the cardiac donor, hemodynamics of the transplanted human heart, the use of antithymocyte globulin in human cardiac transplantation, and control of graft arteriosclerosis in the transplanted human heart. He also participated with Peer Portner and Philip Oyer on the early development of mechanical assist devices, including the Novacor left ventricular assist device.

Drs Shumway and Griep shared a research interest in the application of hypothermia to cardiac surgery. In 1973, Drs Griep, Stinson, and Shumway described the utility of profound local hypothermia for myocardial protection of

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¹Section of Cardiothoracic Surgery, Department of Surgery, Westchester Medical Center, New York Medical College, Valhalla, New York; and ²Department of Cardiothoracic Surgery, Stanford University Medical School, Stanford, California

Address correspondence to Dr Lansman, Section of Cardiothoracic Surgery, Westchester Medical Center, 100 Woods Rd, Valhalla, NY 10595; email: steven.lansman@wmchealth.org.

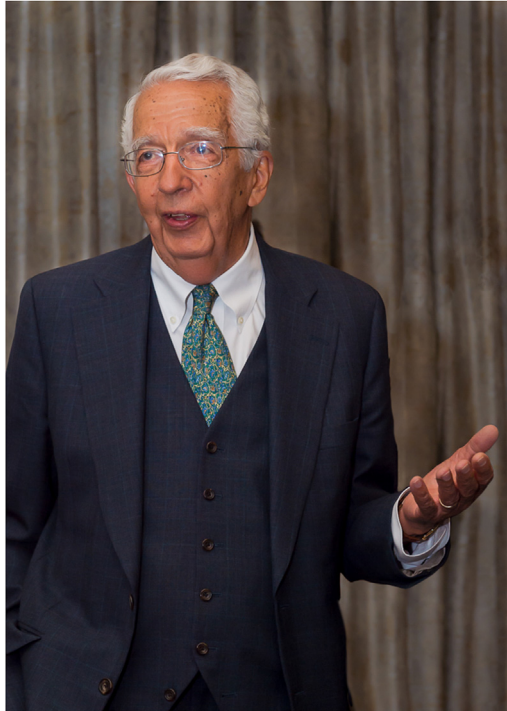


FIGURE 1 Randal B. Griep: master surgeon, innovator, scientist, teacher, and mentor. Photo from Dr Steven Lansman's personal collection.

the human heart during cardiac surgery, a technique that Dr Griep and colleagues used with success in >30,000 clinical cases before switching to blood cardioplegia. In 1975, Dr Griep published a landmark paper describing a technique he had developed for total arch replacement using profound hypothermic circulatory arrest (PHCA, 13.7 ± 1.8 °C) induced by surface cooling. PHCA was used to reduce cerebral metabolic demand to tolerable levels and provide a bloodless operative field in which to work. Remarkably, surface cooling was induced by immersing the anesthetized, intubated patient into an ice slurry in an inflatable canoe placed on the operating table. Dr Griep asked Dr Shumway whether he could include Dr Shumway's name on the paper, which described what became the standard approach worldwide for more than 2 decades, but Dr Shumway declined, because he had initially been skeptical of the idea.

In 1974, Dr Shumway asked Dr Griep to start a dedicated vascular surgery service, with Dr Craig Miller serving as the resident. This effort thrived and grew into a major service at Stanford. Throughout this period, Dr Griep functioned as a junior attending on the cardiovascular surgical service while still completing his chief residency in general surgery in 1976.

In January 1976, Dr Griep was recruited to become chief of cardiothoracic surgery at the State University of

New York, Brooklyn. From 1978 to 1979, due to the untimely demise of Dr Samuel L. Kountz, Dr Griep became interim chairman of surgery for the State University Hospital, Kings County Hospital, and the Brooklyn Veterans Administration Hospital, receiving his General Surgery Boards certificate in the mail shortly after taking on those roles. During this period, Dr Griep continued his work in the surgery of the aortic arch, publishing the first—and at the time the largest—clinical experience with the application of PHCA. He developed an active pediatric cardiac surgery program that included neonatal procedures, he performed 5 heart transplants, and he served as chairman of the National Heart, Lung, and Blood Institute Surgery and Bioengineering Study Section. Importantly, during this era, he teamed up with Dr M. Arisan Ergin, a partnership that proved enormously productive over the coming 25 years in clinical and academic output.

In 1985, Dr Griep was recruited to become chief of cardiothoracic surgery at The Mount Sinai Hospital in New York City, becoming the inaugural chair of the hospital's newly formed Department of Cardiothoracic Surgery in 1988. At Mount Sinai, he built a strong clinical program, world-renowned for expertise in surgery of the thoracic and thoracoabdominal aorta, and developed a busy pediatric cardiac surgery practice.

In 1988, in collaboration with Dr Steven Lansman, Dr Griep initiated—and through 2012 directed—the Aortic Symposium series, an ongoing, biennial, international scientific forum for work concerning thoracic aortic surgery. Among the many distinctions Dr Griep received, he was honored in 2005 by The Society of Thoracic Surgeons with the Earl Bakken Scientific Achievement award and in 2019 by the American Association for Thoracic Surgeons with the AATS Lifetime Achievement award.

Dr Griep's laboratory at Mount Sinai made fundamental contributions to the science and practice of aortic surgery; these can be categorized into 5 broad areas:

PROFOUND HYPOTHERMIC CIRCULATORY ARREST. Beginning with his landmark publication of the technique for arch replacement using PHCA in 1975, Dr Griep characterized the safe limits of this technique for cerebral protection, which turned out to be much shorter than previously appreciated. These studies included measuring the Q_{10} (factor by which the rate of cerebral oxygen metabolism decreases for every 10-degree decrease in temperature) for cerebral metabolism in humans.

NATURAL HISTORY OF THORACIC AORTIC ANEURYSMS. At the first Aortic Symposium, a discussion Dr Griep had with Dr E. Stanley Crawford underscored the lack of data pertaining to the natural history of aortic aneurysm disease. Accordingly, Dr Griep started the Mount Sinai Aortic Database and began a study of manually digitized

serial computed tomographic scans that resulted in 2 important papers characterizing the growth and rupture risk of atherosclerotic aneurysms and dissected aortas.

SAFE INDICATORS FOR SELECTIVE CEREBRAL PERFUSION. Dr Griep and colleagues published a series of articles exploring optimal conditions for the safe use of antegrade selective cerebral perfusion. These studies focused on the roles of temperature, pressure, flow, hematocrit, pH regulation, and cerebral autoregulation.

AORTIC ARCH REPLACEMENT USING A TRIFURCATED GRAFT. A technique developed by Drs Spielvogel and Griep that became widely adopted is the use of a trifurcated graft for aortic arch replacement. This technique can minimize the risk of cerebral atheroembolization, minimize or eliminate the need for PHCA, and is easily adaptable to a variety of anatomical arch anomalies.

THE SPINAL NETWORK MODEL. Apart from the introduction of PHCA into adult cardiac surgery, perhaps the most significant and enduring contribution will be Dr Griep's work identifying and elaborating the critical role of the spinal collateral network in spinal cord protection. Beginning in the 1990s, Dr Griep proposed "the spinal collateral network concept" to explain mounting evidence from his laboratory indicating the existence of an extensive collateral network that supports spinal cord perfusion, consisting of an interconnecting complex of vessels in the intraspinal, paraspinal, and epidural spaces and in the paravertebral muscles. This elegant series of studies detailed the anatomy and physiology of this complex network, emphasizing the importance of multiple inputs to the spinal circulation and included a study wherein direct measurement of collateral network pressure in humans was performed.

Dr Griep had a wonderful, quick, intelligent, and wry sense of humor. He was a gentleman in every sense of the word, treating everyone with respect regardless of their station in life. He was always impeccably dressed; never seen without a three-piece suit and white shirt and tie, except when operating or sailing. He was a self-taught avid sailor. In 2000, he stepped down as chairman and took a sabbatical to cross the Atlantic from Cape Town, South Africa, in a newly built 42-foot catamaran he named *Traveling Light* (Figure 2). He sailed up and down the east coast every summer and took part in 3 regattas to the British Virgin Islands. Woodworking was his hobby, and he was an inventive craftsman, spending an increasing portion of his leisure time building small wooden boats and unusual pieces of furniture, each a work of art.

During his career, Dr Griep trained 32 chief residents and numerous fellows in cardiothoracic surgery, 13 of whom became a chairman or chief of service at their respective institutions. A general feeling on the service was that it was a privilege to be part of that team. He led



FIGURE 2 Randall and Eva Griep next to their sailboat, *Traveling Light*. Photo courtesy of Dr Arisan Ergin, from their personal collection.

by example and instilled and insisted above all else on intellectual honesty. No matter how tired he might be or how many outside pressures he might obtain, you could always count on him to do the right thing. Remarkably unpretentious, given his achievements, he was a caring man, open, not self-centered, and free from envy. Many commented that there was a team personality that flowed from Dr Griep and infused the whole service—a thoughtful approach, style, and demeanor that was so characteristic of him. Usually, one thinks of personality as a characteristic of an individual, but in this case, for a generation of trainees, Dr Griep served as a mentor and, perhaps more importantly as a role model—not only of the kind of surgeon you aspired to be but also the kind of person you wanted to be.

Dr Griep was also devoted to his large extended family. He is survived by his wife Eva, a pediatric cardiologist, and his son, Matthew, a psychiatrist. Dr Griep was an important figure whose career spanned the founding age of cardiovascular and thoracic aortic surgery, the era he called "the golden age of cardiac surgery." He made groundbreaking, fundamental contributions in cardiac transplantation during his early career at Stanford and in the surgical technique and the methods of cerebral and spinal cord protection for thoracic and thoracoabdominal aortic surgery throughout his years at Mount Sinai.

He was an uncommon man.

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