The Department of Surgery at the University of Minnesota is best known for the development of open-heart surgery, the invention of the pacemaker and the emergence of Minnesota’s thriving medical device industry known as Medical Alley. Today, these remarkable events are celebrated at the National Museum of American History in Washington D.C.

While leading Minnesota figures in cardiac surgery—F. John Lewis, C. Walton Lillehei and Earl Bakken, to name a few—have been honored, much of the credit is also attributed to the singular leadership of department chair Owen Harding Wangensteen, who served as the department’s charismatic leader from 1930 to 1967. Fostering an atmosphere that emphasized the need for surgical science, he encouraged surgeons to develop active research agendas in the laboratory. The focus on surgical research and its integration into medical education yielded many important contributions to mid-century surgery beyond cardiology’s impressive results.

Wangensteen presided over an active research program that included the development of nasogastric suction to manage the surgical complications of bowel obstruction and Henry Buchwald’s work on cholesterol metabolism and development of bariatric surgery. Moreover, during the Wangensteen era, the stage was set for the pioneering organ transplant work that followed under John Najarian’s tenure as chair during the 1970s. Wangensteen also supported the work of surgeons such as William Bernstein and Stanley Goldberg.

Beyond cardiac surgery
Owen H. Wangensteen and the University of Minnesota’s contributions to mid-century surgical science

BY DAVID KOROSTYSHEVSKY
who played a central role in the transformation of proctology from a neglected corner of general practice into colon and rectal surgery, a formal specialization within general surgery.

Wangensteen’s rise to prominence did not follow an obvious trajectory. As an adolescent, he never intended to be a physician, let alone a surgeon. He originally wanted to follow in his father’s footsteps by becoming a farmer. With his father’s encouragement, however, he finished college and entered medical school, where he quickly acquired an intense interest in surgery. Even though Wangensteen acknowledged that he was not the best student when he matriculated, he graduated at the top of his medical class. Wangensteen interned at the University’s Elliot Hospital, completed a residency at the Mayo Clinic and earned a doctorate from the University of Minnesota, but then turned down a lucrative opportunity in private practice, choosing instead the much lower salary of a University of Minnesota research professor. This thoroughly Minnesotan upbringing and education would become a source of local pride for his mentors, colleagues and students.

The beginning of Wangensteen’s medical career took place at a time of turbulent institutional change at the medical school that followed the publication of Abraham Flexner’s survey of North American medical education in 1910. While Flexner had found the medical school’s scientific facilities to be “[e]xcellent, exceedingly attractive, and well organized,” he criticized the school’s small clinical facilities and dearth of full-time instructors. Wangensteen interned at the University’s Elliot Hospital, completed a residency at the Mayo Clinic and earned a doctorate from the University of Minnesota, but then turned down a lucrative opportunity in private practice, choosing instead the much lower salary of a University of Minnesota research professor. This thoroughly Minnesotan upbringing and education would become a source of local pride for his mentors, colleagues and students.

Meanwhile, Wangensteen had impressed powerful medical men such as university regent William J. Mayo. The dean of the medical school, Elias Potter Lyon, and the interim leadership committee of the Department of Surgery decided to offer Wangensteen the post. But first, they sent him to Switzerland and Germany, countries whose models of scientific research physicians in the United States esteemed, for a year (1927-1928) to finish his training. There he acquired a passion for laboratory research and the application of historical perspectives to current problems.

Soon after he returned, Wangensteen assumed the chair of the department, became the hospital’s surgeon-in-chief, and immediately dedicated himself to an active research agenda. In the early 1930s, abdominal surgery was still difficult and risky. Wangensteen turned his attention to basic research on the problems of bowel obstruction, which continued to have a high mortality rate. His research revealed that what made recovery from bowel obstruction difficult was the buildup of gas and fluid pressure near the wound, which impeded healing and caused a great deal of pain for the patient. To solve the problem, Wangensteen devised a simple device that applied a slight vacuum delivered to the site by a nasogastric tube. His patients improved immediately and the mortality associated with bowel obstruction dramatically decreased. Thus, the so-called Wangensteen suction device was born. The device, for which Wangensteen won the prestigious Samuel D. Gross Prize in 1935, established him not only as an effective administrative leader, but as a notable surgeon-scientist.

The fame of Wangensteen suction grew during World War II. Intestinal injuries, which required abdominal surgery, were common on the battlefield. GIs with these injuries recovered in special wards, which were known as Wangensteen Alleys for the rows of devices standing next to the beds. An article on the cover of a wartime issue of Minnesota Morning Tribune’s Sunday Magazine, complete with a comic-book drawing of Wangensteen inventing the device, celebrated its life-saving contributions to wartime medicine. His associate and friend, physiologist Maurice Visscher, estimated that by 1944, nasogastric suction “had saved some 100,000 lives.” By the 1970s, the device was still so well-known that it was mentioned in an episode of popular television show M*A*S*H.

Wangensteen’s early research coincided with a broader shift in the medical school curriculum. From 1913 to 1936, Dean Lyon worked hard to implement the recommendations of Flexner’s report. He sought to integrate practical medical education with laboratory research by promoting graduate degrees in clinical areas. This atmosphere shaped Wangensteen’s vision of training surgeon scientists to become scholars as well as clinicians. While Wangensteen understood that the “extra hurdle” of having to do “research and qualify for a graduate degree” was
“frequently resented by fellows” in most medical fields, he believed that the student often learned in the process that professional satisfaction came with the “pursuit of knowledge to advance his chosen discipline through the agency of research.” These values inspired Wangensteen to require most surgical residents to spend a year or two in the research labs as part of their training. Many of them, such as the now-famous cardiac surgeons, earned PhDs along the way. Wangensteen’s favorite research field was physiology. In addition to supporting research within the department, he often assigned residents to work with Maurice Visscher, who joined the Department of Physiology in 1936. While this combination of clinical training with laboratory research by full-time faculty is familiar today, it was a new idea in the 1930s. At the time, only the University of Minnesota and Johns Hopkins University, whose system inspired Wangensteen, trained surgeons this way. 

Wangensteen elevated this vision of scientific surgery to the national level. Unlike young researchers in biomedical sciences, the residents who trained in Wangensteen’s program during the 1930s did not have a venue in which to present the results of their laboratory research. It was then customary for the American College of Surgeons to accept papers by younger surgeons only if they were coauthored with an older, established colleague, a practice that Wangensteen despised. Wangensteen convinced the College in 1940 to establish a forum for young investigators. It became a premier site for surgical researchers, especially residents, to present their work to the profession. In 1993, the College changed its original name from the Forum on Fundamental Surgical Problems to the Owen H. Wangensteen Surgical Forum in honor of its founder.

The opportunity to conduct research attracted residents like Henry Buchwald, who trained under Wangensteen in the early 1960s before joining the faculty. He wanted to become an “academic surgeon” who “engaged in basic research” as well as a “competent clinician” and “technician.” Buchwald recalls, “in that atmosphere, you could come up with ideas… and generally he would tell you to pursue them.” Buchwald turned down an invitation to join Wangensteen’s gastrointestinal physiology lab; he was interested instead in researching “cholesterol metabolism” and its relationship to atherosclerosis and heart attacks, which Wangensteen supported with internal funding until the laboratory secured external grants.

This research directly led to the development of metabolic surgery. Buchwald and his team began by determining which part of the gastrointestinal tract was responsible for cholesterol absorption, which made the first gastric bypass operation possible. Nominated by Wangensteen for this work, Buchwald became the second Minnesota surgeon to earn the Gross Prize. More importantly, early gastric bypass operations to manage cholesterol led to the surgical management of obesity and the development of bariatric surgery.

Buchwald was also active in biomedical engineering research. An active collaboration between surgeons and engineers led to the invention of an implantable drug pump in 1969. While implantable drug pumps never became a useful therapeutic medical device, they inspired the development of infusion portals, implantable devices that simplify the delivery of daily intravenous medication.

The specialization of proctology into colon and rectal surgery is another significant achievement of the Wangensteen era. During the early 20th century, proctology was a neglected area of medical practice. Most physicians were not adequately trained in the treatment of hemorrhoids, fissures, abscesses and fistulas. In response, Walter Fansler, a Minneapolis practitioner, established the Section of Proctology within the Department of Surgery in 1917. Soon after the incorporation of the American Board of Proctology in 1935, Fansler and J.K. Anderson established a one-day training course in proctology at the University of Minnesota. Finishing a preceptorship under Fansler, William Bernstein entered the university community and became a friend of Wangensteen. Succeeding Fansler as director of proctology at the department, Bernstein established a formal residency program in proctology at the University of Minnesota in the early 1950s.

Stanley Goldberg, who, like Buchwald, completed a residency in the 1960s, succeeded Bernstein as chief of a newly renamed Division of Colon and Rectal Surgery in 1972. He has fond memories of Wangensteen’s influence on his decision to become a colon and rectal specialist. “It was really Dr. Wangensteen who had the vision,” recalls Goldberg, that proctologists “should be completely trained as a general surgeon.” In his first year of residency, he met with Wangensteen for career advice and discussed his interest in proctology. “So, Dr. Wangensteen looked me in the eye,” Goldberg remembers, and said, “I want you to change everything.” He “literally outlined my life for me in five minutes.”

David Rothenberger, who trained under Goldberg and would serve as department chair from 2013 to 2017, wrote that under Goldberg’s leadership, the practice of colon and rectal surgery in Minnesota “grew to become the largest such specialty group in the world.”

During the Wangensteen era, Minnesota surgeons were also at the forefront of early organ transplantation. Building on the success of the cardiac program, which worked with critically ill patients, Richard Lillehei—C. Walton Lillehei’s brother—successfully transplanted dog stomachs and intestines in the laboratory as early as 1960. Transplants in human patients began in 1963, when Richard Varco led the first successful human kidney transplant.
in Minnesota. The first liver transplant in the state occurred the following year, performed by Karel Abisolon and Richard Lillehei. And in 1966, William Kelly and Richard Lillehei performed the world's first successful clinical pancreas transplant. And, as is quite well-known, Minnesota-trained surgeons Christiana Barnard and Norman Shumway were performing well-publicized heart transplants by the end of the 1960s.17

These early efforts were hampered by the problem of rejection; while the operations were successful, the outcomes were unpredictable until the advent of immunosuppressive drugs in the following decade. Nevertheless, these early achievements set the stage for major breakthroughs, including solutions for managing tissue rejection, that would follow in the 1970s and '80s. After Wangensteen retired in 1967, John Najarian, a transplant surgeon and research immunologist from California, was attracted to the position specifically because of the department's reputation in surgical research.14 Under his leadership, the department would become internationally-known for transplant immunology research and a clinical destination for organ transplant patients.

Despite the high-profile successes achieved under Wangensteen's leadership, not all the efforts of scientific surgical research in Minnesota translated into therapeutic or clinical applications. As John Delaney, faculty member who trained under Wangensteen in the early 1950s, recalls, one area of research “that didn’t turn out too well” was the “cooling” and “freezing of the stomach” to treat stomach ulcers, another serious medical problem in the mid-20th century. According to Delaney, the research was both “memorable” and “strange.”19 An optimistic article in the New York Times recounted, “In one experiment to develop the technique, a frog” was “given its own oxygen supply” and placed “in the cooled stomach of an anesthetized dog for thirty-six hours.” That the frog “was alive and apparently unharmed when brought out again” was meant to demonstrate the procedure's safety.20 However, by the late 1960s, medical opinion about the procedure became so negative that some researchers erased any mention of it from their CVs.21 Although gastric freezing failed as a practical means to take care of ulcers, Delaney explains, the research still contributed a great deal to basic scientific knowledge about gastric physiology, including the effects of mechanical and thermal injury to the stomach.22

Despite challenges associated with cutting-edge research, Wangensteen's leadership as department chair facilitated the accomplishment of some of the most significant medical triumphs of the 20th century. Indeed, Wangensteen's legacy has become imprinted upon the very geography of the medical campus at the University of Minnesota; dominating the campus skyline, the 11th floor of the Phillips–Wangensteen Building remains the physical home of the Department of Surgery.

In celebration of the department's 110th anniversary in 2016, Minnesota governor Mark Dayton declared Wangensteen's birthday—Sept. 21—to be Dr. Owen H. Wangensteen Day.23 Wangensteen's vision of medical research and education lives on. Within the Department of Surgery, the Division of Basic and Translational Research and Experimental Surgical Services exemplify his commitment to surgical science. Throughout his 37 years of leadership, Wangensteen never wavered in his efforts to integrate scientific research, medical education and history at the University of Minnesota. MM

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