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William Stewart Halsted: Father of the model for our current surgical training programs



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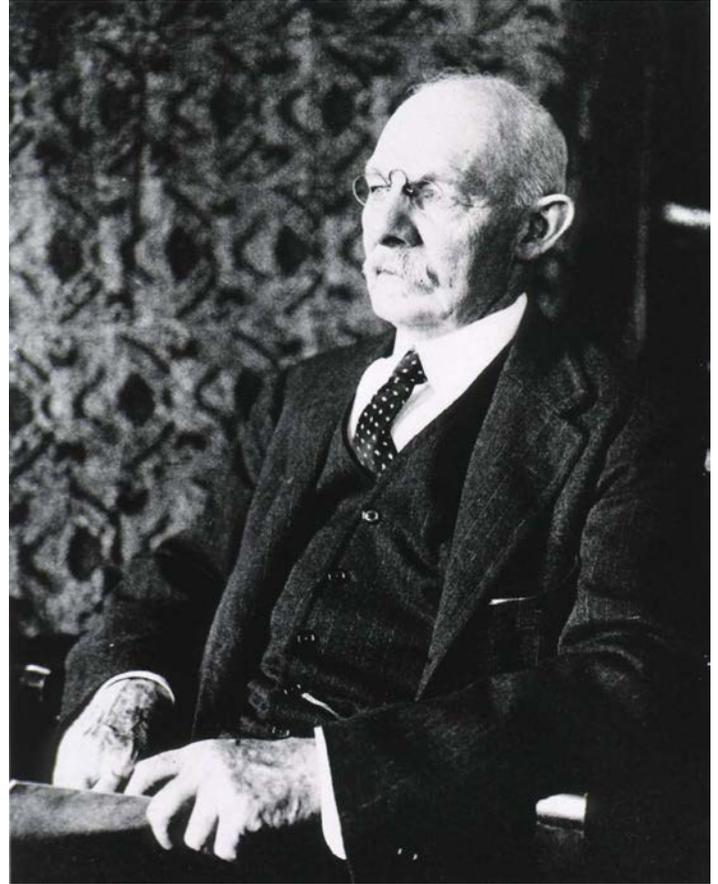
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One of the legendary figures of surgery, William Stewart Halsted (Figure) made contributions that are, in using John Cameron's word, "staggering."¹ His novel surgical techniques influenced surgeons for decades in such wide-ranging areas as breast cancer, hernia repair, intestinal anastomosis, and internal fixation of fractures. He was one of the early American proponents of aseptic surgery. Among his novel contributions were surgical gloves and regional anesthesia. His lasting contribution is his model for surgical training that he established at the Johns Hopkins Hospital. Always on the forefront of medicine, Halsted's independent thinking, scientific knowledge, and solid reasoning motivated practices and innovations that endure as foundations of modern surgical practice.

There are a number of authoritative articles about Halsted and a recent book by Gerald Imber, *Genius on the Edge*.² There is enough in his story to attract Hollywood (Amiels J, Begler M, creators. *The Knick*. Anonymous Productions, 2014–2015). This article uses John Cameron's authoritative profile extensively, with all of the details of his biography coming from his article unless otherwise noted.¹



Background and education

Halsted was born in 1852 in New York City. Educated at home until he was 10, he attended private preparatory schools first in Monson, Mass., and at Phillips Academy in Andover. Before entering Yale University Halsted returned to New York to receive private tutoring in Latin and Greek. His interests at Yale were not solely academic, as he excelled in athletics and competitive sports. In his senior year his interests focused on medicine after discovering the famous anatomy and physiology books of Henry Gray and John C. Dalton. Resolved to pursue a medical career, Halsted returned to New York to enter the College of Physicians and Surgeons.³

With natural ability and an inventive mind, Halsted had the opportunity to learn from the leading physicians in the city. Despite being a year short of graduation he took the internship examination for Bellevue Hospital in New York. He did so well he was offered a post, completing his internship the same year as his graduation in 1877.¹

With a year at New York Hospital as a house physician Halsted completed all the formal training that was available in America. With the financial means of his family in 1878, Halsted set sail to further his medical education at the European centers of surgery and medical scholarship. In Vienna, Würzburg, Halle, and Hamburg he studied with

some of the most notable figures in medical history, such as Zuckerkandl, Billroth, Chiari, von Bergmann, and Volkmann. He established lifelong friendships with Billroth's young assistants Woelfler (first gastroenterostomy, 1881) and Mikulicz (first operation for perforation of the stomach, 1880; operation for pyloric stenosis, 1887).¹

Early career and addiction

After two years abroad Halsted returned to New York where he established an extraordinarily successful practice at the Roosevelt Hospital in 1880. He had a dispensary that became so busy that it met seven days a week and prompted hospital trustees to construct a building devoted to outpatients. He accepted an appointment at the College of Physicians and Surgeons. Bellevue Hospital erected a tent-like surgical pavilion for his sole use to accommodate his demand for a facility where he could properly conduct antiseptic operations.

Indefatigable, he became chief of surgery to the Emigrant Hospital at Ward Island. As visiting surgeon at Charity Hospital at Blackwell's Island he did his operations at night because he was so overcommitted elsewhere. He was a popular teacher, conducting "quizzes," regular review sessions for students cramming for their internship examinations.¹ He wrote papers that he presented to the New York Surgical Society. In 1882 he found time to attend to his sick mother, performing a cholecystostomy to remove stones that were causing sepsis and jaundice.¹

In 1884, only four years into his active career, Halsted read an account of the effects of cocaine in an account of an ophthalmology meeting in Heidelberg reported in the *Medical Record*. He began to experiment with the drug, his extraordinary knowledge of anatomy allowing him to anesthetize peripheral nerves precisely, and recording the effects of various dilutions.² During this work he became psychologically and physically addicted to cocaine, a dependency that would afflict him the rest of his life.⁴

He attempted to shake his dependency by taking a two-month-long sailboat trip to the Windward Islands. Unable to wean his addiction, he broke into the captain's stores to get more of the drug. At his family's urging he was committed to the Butler Hospital in 1886 for a seven-month hospitalization. The facility was able to rid him of a cocaine addiction by giving him morphine injections.¹

Appointment at Hopkins

During his year at New York Hospital Halsted met William H. Welch, at the time a pathologist at Bellevue. Upon his return to America the two became friends, the latter among those alarmed at the effects of his surgical colleague's cocaine addiction. In 1884 Welch was the first physician recruited to the

newly-organized Johns Hopkins School of Medicine, established the year before as the first American medical school committed to graduate education and research. According to Cameron, Welch may have accompanied Halsted on his Windward Island cruise. At the end of Halsted's confinement at Butler Hospital in late 1886, Welch invited his friend to join him in Baltimore.¹

Halsted began work in Welch's lab, where he determined the submucosa as the crucial strength layer capable of holding suture in the intestine. The discovery established the basis for gastrointestinal surgery, providing a structural basis for sutured anastomosis.⁵ On that basis Halsted could be considered the father of surgery on the alimentary tract.¹

Only weeks after presenting his work in Boston 1887, Halsted was back in Butler Hospital, again for a months-long hospitalization. Upon his release in 1888 he returned to Welch's laboratory and began to see patients.¹ When the new Johns Hopkins Hospital opened in 1889 Halsted received the tentative appointment as associate professor in the medical school, surgeon-in-chief of the dispensary, and acting surgeon to the hospital. When the trustees' first choice for surgeon-in-chief to the hospital fell through, Welch had to convince them that Halsted's addiction was sufficiently controlled to allow him to function. Halsted won the appointment in 1890, then was named professor two years later.

As professor and chair of the department of surgery Halsted entered into a period of "monumental productivity...likely never again to be duplicated in American surgery."¹ Cameron lists some of his contributions. Aside from his work on local anesthesia and his work on intestinal suture while drying out in Welch's lab, he continued to perfect his work on inguinal hernia² and mastectomy for breast cancer⁶ that he started in New York. He did the first successful resection for periampullary cancer and the first choledochotomy in the country. He was active in vascular surgery, being the first to resect a subclavian aneurysm, and attempting operations to control aortic aneurysm.

Famously inventing surgical gloves to protect the hands of his scrub nurse, Caroline Hampton, who would become his wife, he pioneered other practices that promoted "safe surgery."¹ Speed and boldness in surgery were still stubborn vestiges of an era before pre-anesthesia when surgeons wore frock coats soaked with blood and body fluids. Halsted recognized that anesthesia allowed patient and careful dissection and gentle handling of tissues to avoid creating devitalized areas prone to infection. Dead space was closed and preferably avoided altogether. Asepsis allowed the use of fine silk suture without a significant increase in the risk of infection rather than catgut, heavy and clumsy in comparison. He demanded other surgeons in his department to follow his concepts.²

Surgical education

As important as Halsted's innovative procedures and surgical techniques, many consider his most important accomplishment to be his model for surgical training. The system would train surgeons and leaders in the field to the present day.

Halsted was among the fortunate that could supplement his medical education with a hospital internship, a year's appointment as house officer, then travel visiting surgical clinics abroad. Medical school graduates could practice with the knowledge they had, or enter an apprenticeship if wanted to further their knowledge in a given area. There were no rules, regulations, or guidelines. The length of the relationship was determined by the trainee, and terminated when money ran out or nothing more could be learned. Mentors had varying abilities and experience, leaving their trainees with uncertain levels of experience. Surgeons in particular had no interest in training someone who might open a practice next door.

While in Europe, Halsted saw more structured training programs. His time in Europe is widely thought of to be the source of his concepts of surgical training.

Soon after his promotion to surgeon-in-chief of the Johns Hopkins Hospital in 1889 Halsted organized the first surgical training program in the U.S. He was uncompromising in his standards. Trainees had to be available 24 hours a day, seven days a week.⁷ Naturally this meant they had to reside in the hospital and be unmarried. Only men were accepted into the residency. There was no set length of training. It was Halsted's decision when a trainee was ready for practice, a decision made on his own assessment of capabilities, talent, and skill.

A key feature of Halsted's system was "graduated responsibility." He established a hierarchy of junior assistant residents, assistant residents, and finally a single trainee referred to as simply, "the resident," second only to Halsted who stood at the apex. As trainees advanced, they would adopt increasing responsibility. Not every trainee started as junior assistant resident, and promotion was not assured. Not all assistant residents advanced to the top post. Halsted selected only the best candidates for his residency, and most importantly to him, only the best would finish.

Future of the Halsted model

Just as Halsted modified the German system, today's training programs are the result of important changes in his system. Abandoned are the severe culling process of the pyramidal junior assistant - senior assistant - resident framework and the indeterminate length of training. Presence in the hospital is limited to 80 hours a week, the 24-hour, 7-day presence in the hospital a long-forgotten relic. Women training in surgery are now commonplace. Struggling to be preserved is the "graduated

responsibility" ethic; while trainees participate in operations of increasing complexity as they progress through their training, none have the opportunity to exercise independent decision-making and have sole responsibility in the operating room.

Halsted's system for surgical training is a durable framework. Surgeons will undergo training in residencies under the supervision of more senior trainees and attending surgeons. Some procedures are the same, many more are different, and the technology is unimaginably different. Many of the rules are different, but its basic structure bears the imprint of its founder.

References

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Legends

Figure. William Stewart Halsted. Image from the National Library of Medicine.