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William Halsted (1852-1922): one of America's greatest surgeons and the surgical treatment of breast cancer

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Summary

Halsted, an awe-inspiring teacher, more than any other American surgeon, innovated the American surgery and created the foundation on which the American school of surgery rests. Halsted is regarded as the individual who popularised the use of surgical rubber gloves, of "Listerism", of local anaesthesia and established a new effective surgical treatment of breast cancer.

Key words: american surgery, breast cancer, Halsted mastectomy, William Halsted

"We need a system, and we shall surely have it, which will produce not only surgeons but surgeons of the highest type, men who will stimulate the first youths of our country to study surgery and to devote their energies and their lives to raising the standard of surgical science"

William Halsted

Life, career and scientific works

William Halsted (Photo 1) was born in New York City into a well-to-do merchant family whose members had originally emigrated from England in the 1640s. He graduated from Yale University in 1874 and soon matriculated at the College of Physicians and Surgeons in his native city. Halsted was an excellent student and ranked among the top ten members of his medical school's graduating class in 1877. During his studies Halsted had as preceptor Henry Sands (1830-1888), who was professor of anatomy and a highly regarded surgeon. In addition, Halsted became student assistant to John Dalton (1825-1889), a pioneer experimental physiologist. These two men would have an important influence on Halsted's later role as an experimental surgeon [1].

Halsted served an 18-month internship at Bellevue Hospital and a short stint as house surgeon to the New York Hospital. Financial means were available, so Halsted departed for Europe to further his education. In a letter he wrote to William Welch (1850-1934), professor of pathology at Johns Hopkins and his lifelong confidant, Halsted provided some idea of

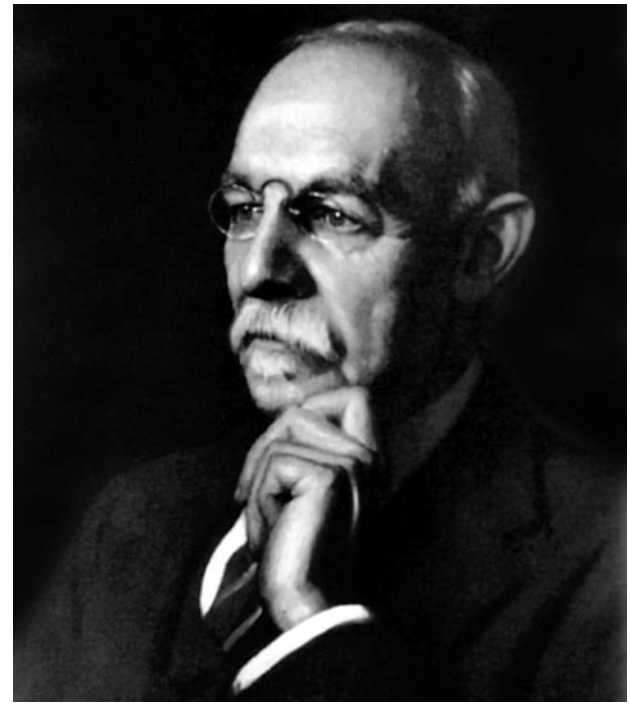

Photo 1. Halsted in an oil painting copy of John H. Stocksdale's photograph from 1922.

the depth and variety of his contacts and experiences during his European stay:

"In the fall of 1878 I sailed for Europe…anatomy was my chief work…took a train arriving in Vienna… attended the clinics of Billroth…My work with the embryologist Schenck was chiefly valuable because it led to friendly relations with Wolfler, Billroth's first assistant. We dined together not infrequently, and he gave me unrestricted entrée to the surgical wards… What impressed me chiefly was the magnitude of the operations, the skill of Billroth and his assistants, particularly Mikulicz, and the great number of artery forceps used…leaving Vienna in the spring of 1879 I went to Würzburg and attended the clinics of von Bergmann regularly…returned to Vienna in the autumn…. Soon after Easter I deserted Vienna for Leipzig…I enjoyed the clinics of Thiersch although his operations were generally minor ones … traveled to Halle where with Volkmann I spent several profitable weeks… Volkmann invited me to his house several times…from Halle I went to Berlin, Hamburg (Schede), and I think, Kiel (Esmarch)…returned, via Paris and London, to New York early in September 1880" [2].

Halsted returned to New York in September 1880. He immediately was appointed demonstrator of anatomy at his alma mater and accepted an offer by Sands to become his associate in surgical practice at the Roosevelt Hospital. The early 1880s were wondrous years for the young surgeon. Unlike his later years, when his addiction to cocaine had changed his personality into that of a socially distant and overwhelmingly reserved individual, these early years in New York were filled with an active social life [3].

Between 1882 and 1886 Halsted published or presented more than 20 scientific papers on a wide variety of topics.

In late 1884 or 1885 Halsted and several of his associates at Roosevelt Hospital, including Richard Hall (1856-1897) and James Corning (1855-1923), began performing experiments with cocaine and demonstrated that it could be used to anaesthetize deeper structures via injection into all parts of the body. Such conduction anaesthesia gained rapid popularity, since it was simple and required minimal amounts of cocaine.

Halsted and his colleagues quite innocently became habituated to the use of cocaine. As the effects of addiction became worse, Halsted was threatened with professional extinction. In periods of agitation engendered by the drug he turned to morphine and alcohol. His attendance at meetings dropped off, and by April 1885 he could no longer deliver a series of lectures in competition for the chair of surgery at his alma mater. In 1885 Halsted wrote his *Practical Comments on the Use and Abuse of Cocaine* [4].

Halsted's health steadily declined; in February 1886 he took an extended sailing trip to the Windward Islands in the hope of restoring his former self. The effort was to no avail, and in May, with the encouragement of his friends and family, he voluntarily committed himself to the Butler Hospital in Providence, Rhode Island, a leading mental hospital that included alcoholics and drug addicts on its patient list. He was discharged in November 1886 after 7 months of inconclusive treatment. It is likely that during this time he was weaned from cocaine but became dependent on morphine. Halsted realized that his career in New York was over and accepted an invitation by his old friend Welch to come to Baltimore and work in his new laboratory at the Johns Hopkins University. It is interesting, in view of Halsted's later prominence and surgical accolades, that when Halsted first went to Baltimore it was neither to accept a professorship nor to assume chairmanship of a department but to accept the offer of a friend who wanted to help him in dire times. Welch was fully aware of Halsted's tragic problems but also sensed his potential. All was not well, however, and in April 1887 Halsted reentered the Butler Hospital after stopping at the Harvard Medical School to present his work on the circular suture of the intestines, which stressed the importance of the submucosal layer. This time, Halsted remained at the Butler Hospital for 9 months, until the last day of 1887. His problems had been "treated"; he was listed as recovering from the opium habit [3].

Halsted returned to Baltimore in January 1888 and began working once again in Welch's laboratory. He began to see patients and perform surgery at various hospitals around the city. It was his hope to become a staff member of the about-to-open Johns Hopkins Hospital. Finding a professor of surgery for the institution was difficult, and finally, in February 1889, after apparent improvement in his health, Halsted was appointed surgeon-in-chief to the outpatient dispensary and acting surgeon to the hospital. Later that year he became associate professor, but he was not named professor of surgery until 1892. Regardless of historical conjecture and innuendo, it is a fact that Halsted continued to use morphine throughout his life. Other than the definite change from the former *joie de vivre* of his personality, there was no apparent physical or mental deterioration, despite his 40-year drug addiction. From 1889 until his death in 1922 Halsted directed a department that produced an impressive array of surgical talent, which in turn brought his own philosophy to chairs of surgery throughout the United States [5].

Founder of a new American surgery

The two years spent in Europe made a profound impression on Halsted. He could not help but notice the stark contrast between the American and German standards of surgical training. Although a few so-called teaching hospitals existed in the United States, their approach to surgical education consisted mainly of limited operating-room work, with almost no integration of the fundamental sciences with clinical diagnoses and treatment. Inevitably, therefore, most American surgeons were self-taught. The self-made surgeon was not overly eager to hand down the valuable, hard-earned skills to younger men who wished to learn but were certain to become competitors.

It is difficult to assign the role to one particular German surgeon of having provided the major influence on Halsted and his educational philosophies. More likely, the entire scholastic milieu of Germany in the mid-nineteenth century had the most enduring influence on Halsted's later surgical and educational beliefs. The young, impressionable American surgeon, in making his first tour of the German-speaking countries, could not have failed to notice the overwhelming success of the German educational system in training surgeons of the highest order. These impressions would later be translated into a new order of American surgery based on Halsted's principles.

The resident system of training surgeons, which Halsted inaugurated at the Johns Hopkins Hospital, was not merely the first program of its kind in America; it was unique in its primary purpose. Above all other concerns, Halsted desired to establish a school of surgery that would eventually disseminate throughout the surgical world the principles and attributes he considered sound and proper. His aim was to train surgical teachers, not merely competent operating surgeons. During the 33 years he spent as director of his system of surgical training, Halsted appointed 17 resident surgeons (Photo 2). Of these men, 7 became professors of surgery, including Harvey Cushing (1869-1939) at Harvard; Stephen Watts (1877-1953) at Virginia; George Heuer (1882-1950) at Cincinnati and Cornell; Mont Reid (1889-1943) at Cincinnati; John Churchman (1877-1937) at Yale; Robert Miller (1886-1960) at Pittsburgh; and Emile Holman (1890-1977) at Stanford. Roy McClure (1882-1951) was named surgeon-in-chief at the Henry Ford Hospital in Detroit; James Mitchell (1871-1961) became professor of clinical surgery at George Washington University; Joseph Bloodgood (1867-1935) and Walter Dandy (1886-1946) remained on staff at Johns Hopkins. Other prominent assistants of Halsted were Hugh Young (1870-1945), professor of urology, William Baer (1872-1931), professor of orthopedic surgery and Samuel Crowe (1883-1955), professor of otolaryngology, all of whom remained at Johns Hopkins [6].

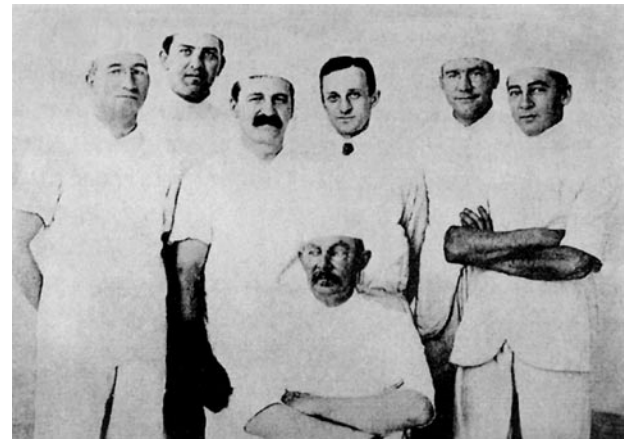

Photo 2. Halsted with his ex-residents in 1904 at the Johns Hospital. Halsted is seated.

Although other surgeons had more international reputations, it was Halsted who set the tone for the final period of American surgical history in the 19th century. His work reveals the beginning of a new American surgery based as much on physiology as on anatomy [7]. Halsted moved surgery from the heroics of the operating "theater" to the relative sterility of the operating "room" and the privacy of the research laboratory. American surgery was becoming a true science, and the recognition of surgery's true therapeutic powers would follow [8].

By 1889 Halsted had devised a modern operation for the treatment of inguinal hernia (Figure 1). During the 1890s he authored a series of papers describing a method of radical mastectomy as treatment for breast cancer (Figure 2). In 1892 Halsted completed the first successful ligation of the left subclavian artery. A decade and a half later, in 1909, he introduced metal band in place of a ligature for the occlusion of arteries. In that same year Halsted performed some of the earliest work on the transplantation of parathyroid glands. He is eponymically associated with many things, including a stitch placed through the subcuticular fascia for exact skin approximation.

In 1912 Halsted asked Samuel Crowe to organize the university department of laryngology and otology and to include diseases of the thorax [9].

The Halsted radical mastectomy

In Germany, the concept of cancer dissemina-

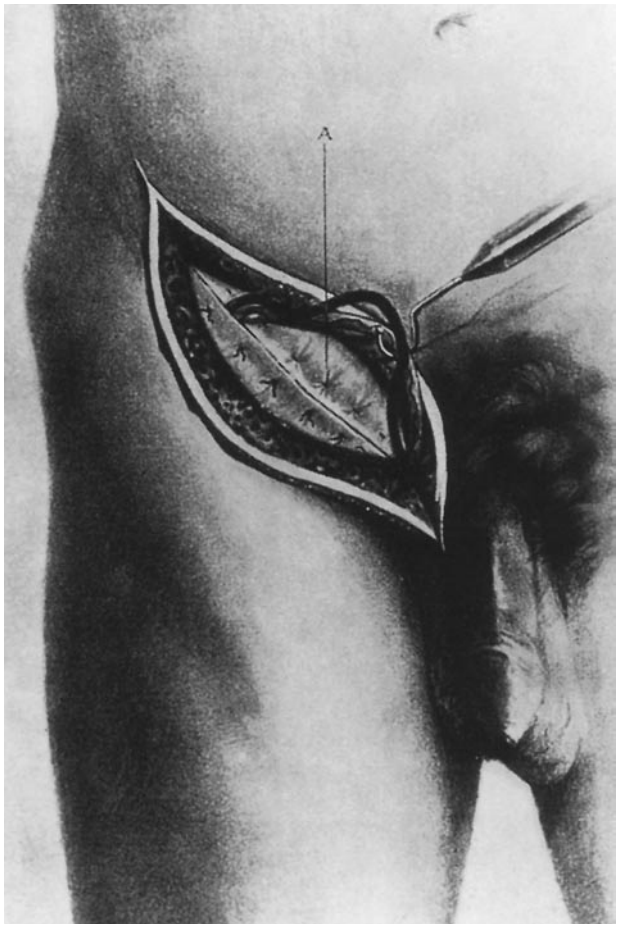

Figure 1. Halsted's repair of inguinal hernia.

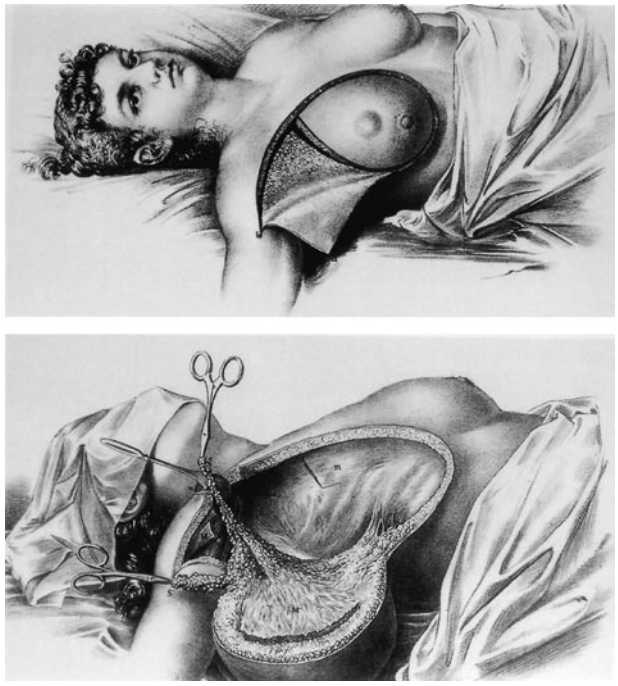

Figure 2. These engravings represent the earliest presentations of Halsted's radical mastectomy in pictorial form (1894).

tion via the lymphatics was developed thanks to the work of Richard von Volkmann (1830-1889) of Hale, and Lothar Heidenhain (1860-1940) of Berlin, who published a detailed study of the spread of breast cancer in 1889.

Volkmann himself, by 1875, was advocating routine removal of the fascia over pectoralis major together with the entire breast and an extensive portion of the overlying skin, together with removal of the entire fatty tissue of the axilla. If the underlying muscle was bound to the tumor a thick layer of muscle was also excised [10].

Gradually, surgeons were moving to the concept of radical mastectomy, whose detailed technique was evolved by Willy Meyer (1858-1932) of the New York Hospital and Halsted (Photo 3).

Meyer drew attention to the danger of dissemination of the cancer cells in the wound if the tumor was handled during the operation and in 1894 wrote:

"Since Heidenhain has shown that in a great number of cases of cancer of the breast the pectoralis major muscle is also involved by the disease and that, if left in place, the growth is more liable to recur, it has become, I believe, the duty of the surgeon always to remove this muscle with the breast and the axillary contents…" [11].

Meyer included removal of pectoralis minor in his operative procedure, a technique later adopted by Halsted. The large wound defect was treated by skin grafting about 8 to 10 days after the initial mastectomy [12].

Halsted did much to pioneer the operation of radical mastectomy which, in the United States, was often termed "the Halsted mastectomy" (Photo 4). In 1894 he wrote :

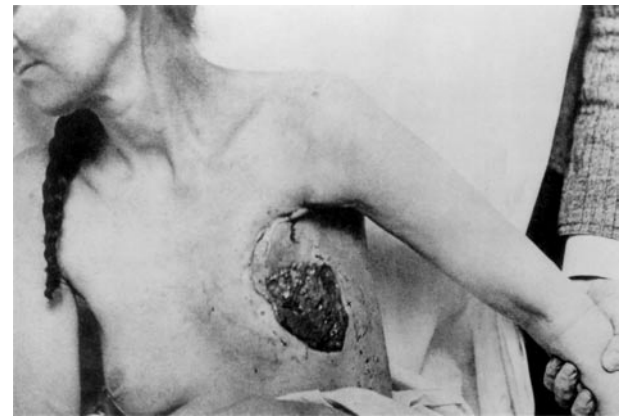

Photo 3. The first published photograph of Halsted's wound for radical mastectomy. The open portion of the incision is completely filled with a blood clot.

Photo 4. The earliest photograph of a Halsted radical mastectomy, taken just before the final excision of the breast, pectoral muscles, and axillary contents.

"About eight years ago I began not only to typically clean out the axilla in all cases of cancer of the breast but also to excise in almost every case the pectoralis major muscle or at least a generous piece of it, and to give the tumor on all sides an exceedingly wide berth. It is impossible to determine with the naked eye whether or not the disease has extended into the pectoral muscle" [13].

By 1898, Halsted was advising dissection of the supraclavicular nodes in the majority of the cases and even removal of the mediastinal nodes, although, in later years, he abandoned the supraclavicular part of the dissection. Halsted was also performing immediate skin grafting to the resultant large raw area, having used the available skin to cover the axillary contents [14].

By 1907, Halsted was able to demonstrate the well known relationship between the staging of the tumor and its prognosis. In a series of 210 radical mastectomies, 60 patients had axillary nodes which were shown to be negative for tumor, and 85% of these were alive 3 years later. In 110 patients with axillary nodes involved, survival dropped to 31%. In 40 patients in whom both axillary and supraclavicular nodes were involved, the survival was only 10% [15]. We have already noted, of course, that many of Halsted's so-called "early cases" are what we would regard today as locally advanced tumors and it is not surprising, therefore, that there was an overall 64% death rate with local or distant recurrence within 3 years of mastectomy (Photo 5).

Discussion

Halsted was an extraordinary man. His contribution to aseptic surgical technique is considerable by the introduction of surgical gloves, the support of "Listerism" and his work on local anesthesia (Photo 6).

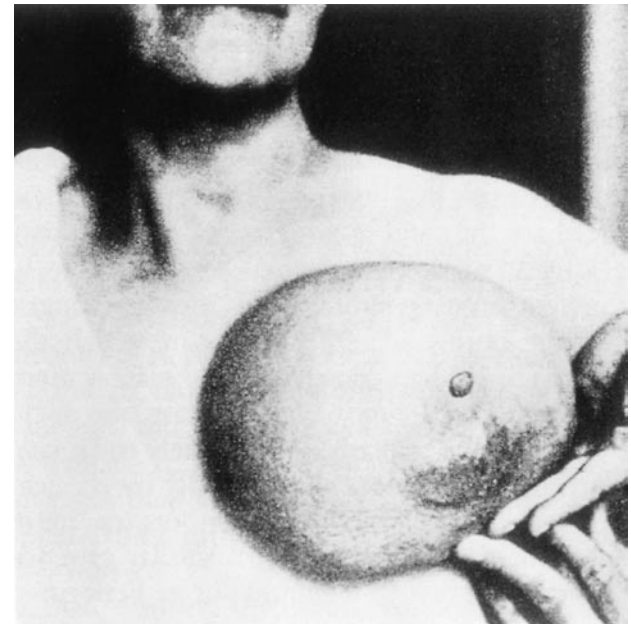

Photo 5. Patient submitted to radical mastectomy by Halsted in 1912. Today this tumor would be regarded as technically inoperable.

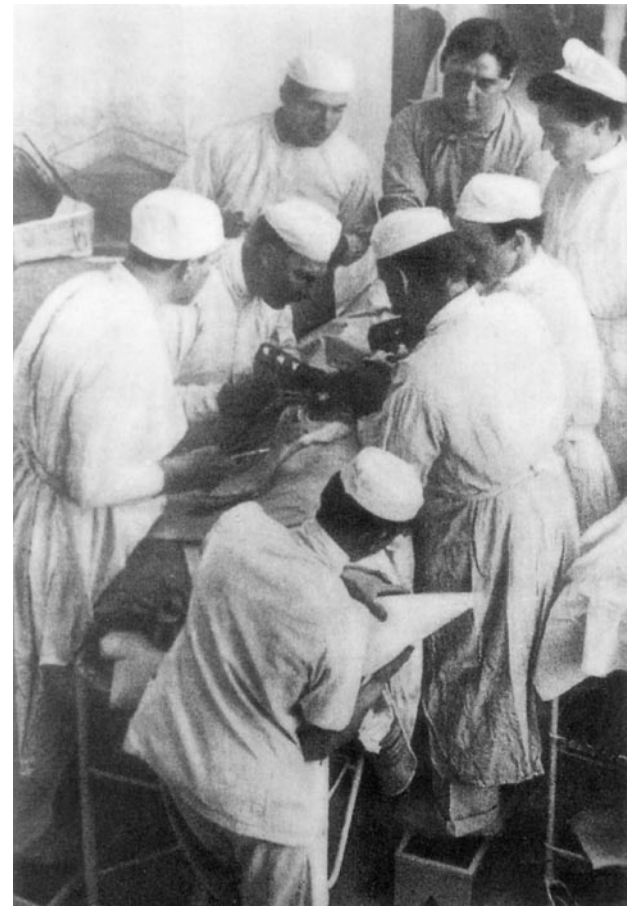

Photo 6. Halsted's first operation in the new surgical amphitheatre at Johns Hopkins Hospital in 1904.

Photo 7. Halsted and Theodor Kocher in Inselpital in Bern, Switzerland, performing an operation (1911).

Although Halsted (Photo 7) neither invented rubber gloves nor originated their use in surgery, he was the first to promote their widespread application in the surgical community and he is consequently credited with the discovery of rubber surgical gloves (Photo 8). Halsted became interested in the use of rubber gloves as a way of protecting the hands of his favorite operating-room nurse, in whom a dermatitis caused by mercuric chloride developed in 1889.

In 1913 he described the conditions of the introduction of gloves in his clinic : "*...In the winter of 1889 and 1890… the nurse in charge of my operating-room complained that the solutions of mercuric chloride produced a dermatitis of her arms and hands. As she was an unusually efficient woman, I gave the matter my consideration and one day in New York requested the Goodyear Rubber Company to make as an experiment two pairs of thin rubber gloves with gauntlets. On trial these proved to be so satisfactory that additional gloves were ordered… I stated that the assistant who passed the instruments wore rubber gloves. This assistant was given the gloves to protect his hands from the solution of phenol (carbolic acid) in which the instruments were submerged rather than to eliminate him as a source of infection… Dr Hunter Robb in 1894, in his book on aseptic techniques, recommended that the operator wears rubber gloves …Thus, operating in gloves was an evolution rather than an inspiration or happy thought, and it is remarkable that during the 4 or 5 years when as operator I wore them only occasionally, we could have been so blind as not to have perceived the necessity for wearing them invariably at the operating table."* [3].

The ending of the Halsted-Hampton story is a romantic one; the following year they married!

The carbolic-acid technique, called "Listerism" as often as "antisepsis" was delayed in the United States although Halsted understood its value quickly. Halsted encountered so much opposition that he had to operate in a tent in the garden of Bellevue Hospital in New York, as his colleagues hated the fumes of carbolic acid.

Cushing wrote after Halsted's death: *"A man of unique personality, shy, something of a recluse, fastidious in his tastes and in his friendships, an aristocrat in his breeding, scholarly in his habits, the victim for many years of indifferent health, he nevertheless was one of the few American surgeons who may be considered to have established a school of surgery comparable, in a sense, to the school of Billroth in Vienna. He had few of the qualities supposed to accompany what the world regards as a successful surgeon. Overmodest about his work, indifferent to matters of priority, caring little for the gregarious gatherings of medical men, unassuming, having little interest in private practice, he spent his*

Photo 8. One of the original rubber surgical gloves designed by Halsted and preserved in Lucite.

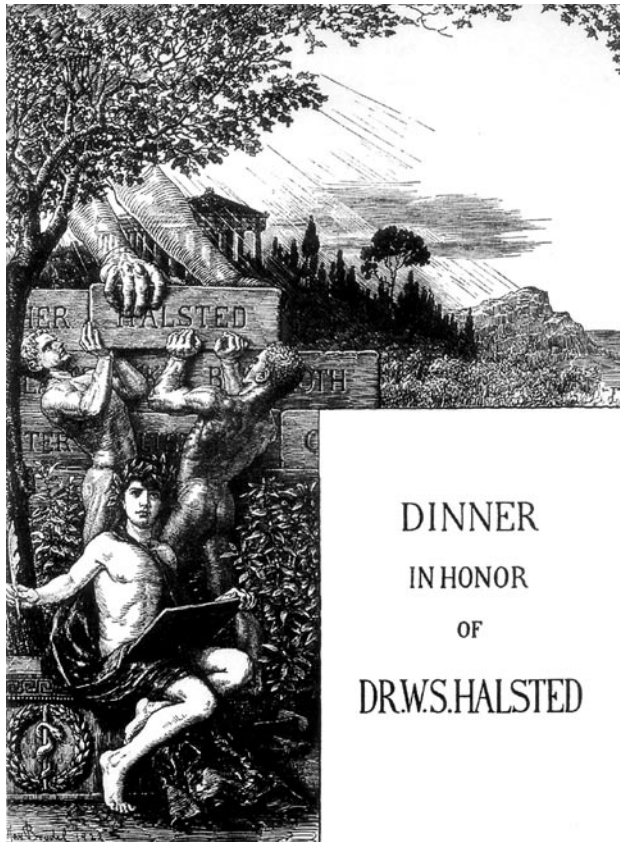

Figure 3. Invitation to a dinner during which a gold medal was presented to Halsted by the National Dental Association, Baltimore, April 1922.

medical life avoiding patients-even students when this was possible – and, when health permitted, working in clinic and laboratory at the solution of a succession of problems which aroused his interest. He had that rare form of imagination which sees problems, and the technical ability combined with persistence which enabled him to attack them with promise of a successful issue. Many of his contributions, not only to his craft but to the science of medicine in general, were fundamental in character and of enduring importance" [7].

Epilogue

Although Halsted has long been recognized for his original contributions to the science of surgery, (Halsted mastectomy, introduction of surgical gloves, support of "Listerism", works on local anesthesia), the most far-reaching of his concepts lay in the education, training, and inspiration of a school of surgeons who were imbued with his principles of thought and action. The "Halsted tradition" remains the *sine qua non* of modern surgical residencies (Figure 3).

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