Chapter 2

HISTORICAL PERSPECTIVES ON THE CARE OF SERVICE MEMBERS WITH LIMB AMPUTATIONS

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INTRODUCTION

Since the US Civil War, philanthropy and military medicine have gone hand-in-hand in various systems of care available to US military service members with limb amputations. As a new century brings changing methods of warfare, this partnership is continued by the major military amputee care centers located across the United States: the Center for the Intrepid (CFI) at Brooke Army Medical Center, San Antonio, Texas; the Comprehensive Combat and Complex Casualty Care at San Diego Naval Medical Center, California; and the Military Advanced Training Center at Walter Reed Army Medical Center, Washington, DC. Altruism helped establish each of these facilities, and it remains vital to their missions of rehabilitating service members with limb amputations and reintegrating these men and women into civilian society.

The CFI emerged chiefly through a fundraising campaign by private citizens Arnold Fisher and Ken Fisher, a father-and-son business team who established and currently oversee the nonprofit Intrepid Fallen Heroes Fund and the Fisher House Foundation. At the CFI and around the country, as explained in Chapter 1, Introduction: Developing a System of Care for the Combat Amputee, these charitable organizations work alongside others in close cooperation with military officials to provide financial, material, and peer support to service members with limb amputations and related injuries, and to the families of service members who have given their lives in current military operations.[1,2] The other two centers resulted from philanthropy of a different form, namely that of US taxpayers displayed collectively through the US Congress.[3,4] At both sites, and no less at the CFI, nonprofit organizations like those described in Chapter 7, Military and Veteran Support Systems, cooperate with military officials to administer "peer visitor," recreational, and other psychosocial programs for service members with limb loss and other injuries and for their families and loved ones.[5]

This introduction provides historical perspective on these present-day connections between philanthropy and military medicine, defining philanthropy broadly as the altruistic concern for human welfare and advancement manifested by endowment or donations of money, property, or work. The chapter's chief purpose is to inform readers that today's partnership of civilian altruism and military medical rehabilitation has deep roots in the past, taking various forms since the mid-19th century and playing an influential, if underappreciated, role in the care of service members with limb amputations. Understanding this partnership is critical as care providers consider not only current and future surgical and medical care available to these men and women (as discussed in Chapters 8–16) but also the best therapeutic and technological means (as discussed in Chapters 17–27) to enable their best possible health outcome and participation in society despite their physical and psychological challenges.

BACKGROUND

As many historians and medical experts have documented at length in the professional literature, the past 2 centuries have marked significant changes in military technology, tactics, and injuries of service members.[6–11] As firepower on the battlefield evolved from the rifled musket and minié ball of the US Civil War to the explosive artillery and machine gun of World War I to the high-velocity rifle of the Vietnam conflict, surgeons faced ever more serious wounds requiring treatment. Paralleling these changes in firepower were various innovations that combined to increase the odds of surviving wounds in theater. These included technology of transportation, such as the locomotive, automobile, airplane, and helicopter, which separately and together improved evacuation from the front lines, as well as the field of materials science, as armor for individuals and vehicles helped reduce injury. Finally, technological innovations in the field of medicine, such as radiology, aseptic techniques, blood banking, and antibiotics helped improve initial and long-term treatment.

Current military transport evacuates injured service members from the area of operations to the continental United States more rapidly than in any other time. Patient care during flight continues in the same comprehensive and aggressive manner as it does on the ground, a practice that was largely absent in the past because of technological limits. Upon arrival at a US military hospital, service members with injuries enter into treatment plans shaped by knowledge and practice gleaned from past conflicts and from the best standards of civilian care. For example, patients who have sustained blast injuries have contaminated and dirty wounds. If such wounds are not treated properly, gangrene, sepsis, and death can occur. Aggressive wound irrigation and debridement, placement of antibiotic beads in the wound, soft-tissue grafting, and vacuum-assisted closure are examples of current techniques to salvage injured limbs and maximize the length of residual limbs that require amputation.

Interdisciplinary approaches to care begin in the acute phase and continue through all stages of medical rehabilitation to help patients reach the highest level of recovery possible in subsequent years.

With unique perspectives drawn from the US Civil War to the current global war on terror, this chapter aims to enrich appreciation of the value of philanthropy for care of the combat amputee both today and in the past, as well as the history of medical specialities that constitute the rehabilitation team and philanthropic organizations engaged in the care of both injured service members and their families and loved ones. This historical knowledge puts into perspective the current and future care of injured service members, showing that while their immediate care is a response to wounds sustained in combat, their longer-term physical and psychological rehabilitation should involve critical thinking not only about treatment by the various branches of military and civilian medical science but also about the engagement of civilian philanthropy in renewing their health and social participation.

CIVIL WAR

During the Civil War, amputations constituted approximately 75% of all operations performed, and among Union forces over 21,000 service members survived amputation procedures. Because antiseptics and disinfectants were not yet widely recognized, and specific treatments involving alcohol and opiates had limited success, many patients survived amputations only to suffer devastating postsurgical infections.

The writings of Walt Whitman (Figure 2-1) provide a graphic description of Civil War amputation. In 1863 Whitman traveled from Boston, Massachusetts, to Washington, DC, in search of his brother, George, whose name was listed in a newspaper casualty roster from the battlefield at Fredericksburg. After searching nearly 40 Washington hospitals, Whitman traveled from Washington to Fredericksburg to find George alive with a superficial facial wound. However, Whitman's personal relief quickly turned to horror at the costs of battle (Figure 2-2). As he wrote in his notebook, "I notice a heap of amputated feet, legs, arms, hands, &c . . . human fragments, cut, bloody black and blue, swelled and sickening."[12] Moved by the human dev-

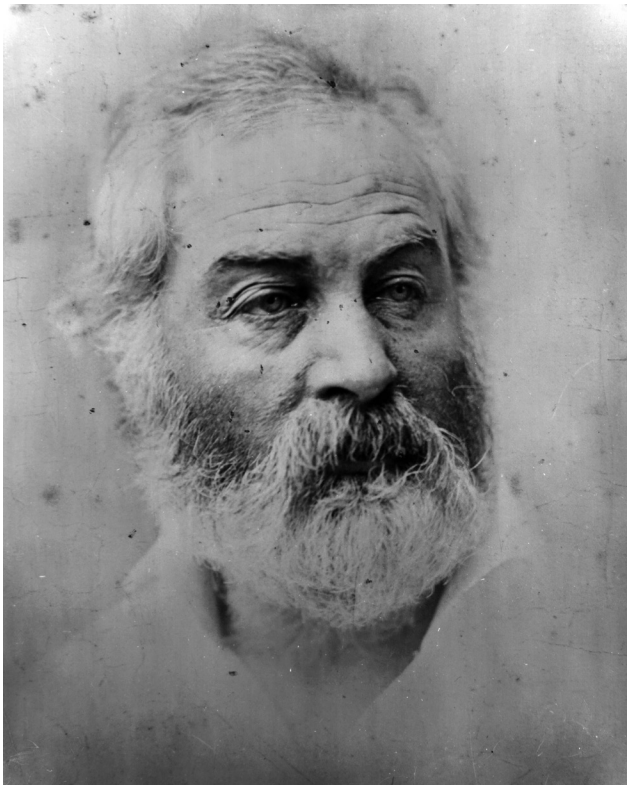


Figure 2-1. Walt Whitman (1819–1892), photographed in 1863, the same year he traveled from Boston to Washington, DC, in search of his brother, George.
Photograph: Courtesy of Library of Congress, Washington, DC. Feinberg-Whitman Collection, LOT 12017, box 1.

Figure 2-2. Amputations at Harewood Hospital, Washington, DC. This photograph by Dr Reed Bontecou, titled "Field Day," reflects a scene similar to that witnessed by Whitman in Fredericksburg, Virginia.
Photograph: Courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. CP 1043.

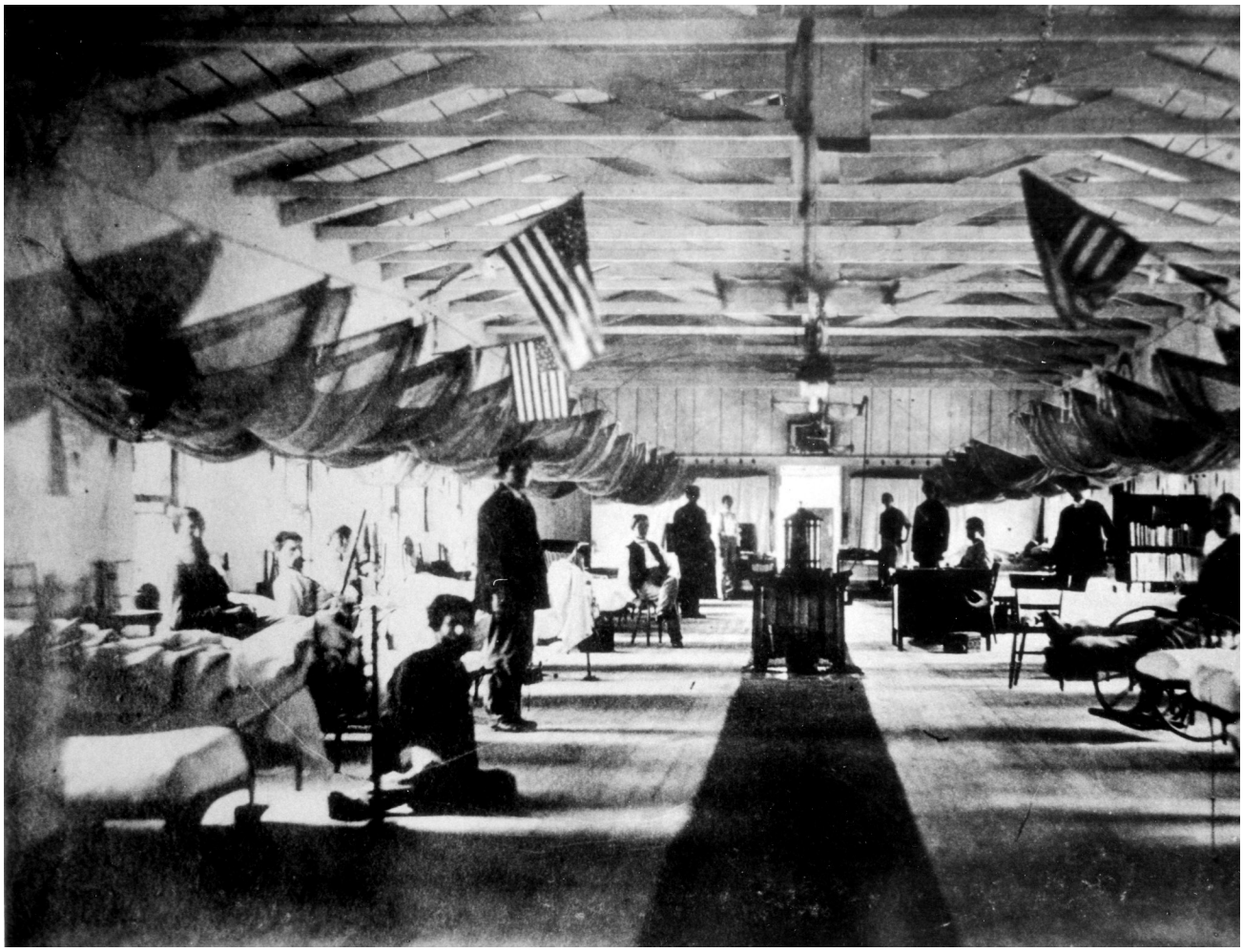


Figure 2-3. Armory Square Hospital, Washington, DC, where Whitman began defining his approach to wartime philanthropy. Photograph: Courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. CP 2241.

astation he witnessed, Whitman traveled to Armory Square Hospital in Washington, DC (Figure 2-3), where he developed his own approach to wartime philanthropy by looking after many combat-wounded soldiers, recording their stories, composing letters for them, corresponding with their loved ones, giving them small gifts, and comforting them through conversation.

Hundreds of men benefited from Whitman's philanthropic spirit, including Private Oscar Cunningham of the 82nd Ohio Infantry, who, during the battle of Chancellorsville in May 1863, received a gunshot wound to the right thigh that resulted in a compound fracture. The bullet was extracted at Armory Square Hospital on June 15th by Dr D Willard Bliss (Figure 2-4), the hospital's chief surgeon, whom Whitman later described as "one of the best surgeons in the army."[13] Extensive abscesses formed following the procedure, and on May 2nd, 1864, Bliss amputated Cunningham's leg and, shortly thereafter, forwarded a portion of it to the Army Medical Museum for preservation as a specimen that could teach future surgeons about military medicine of the day (Figures 2-5). Just after Cunningham's amputation Whitman stated in his journal that "he is in a dying condition—there is no hope for him—it would draw tears from the hardest heart to look at him—he is all wasted away to a skeleton, & looks like some one fifty years old—you remember I told you a year ago, when he was first brought in."[14] Whitman continued, describing Cunningham in his own way as "the noblest specimen of a young western man I had seen, a real giant in size, & always with a smile on his face—O what a change, he has long been very irritable, to every one but me, & his frame is all wasted away."[14]

Cunningham died on June 4, 1864. He was one of the first soldiers to be buried in what was then the new Arlington National Cemetery. His lower thigh bone remains preserved in the modern iteration of the Army Medical Museum, the National Museum of Health and Medicine, Armed Forces Institute of Pathology, as a reminder not only of surgical technique but also of the suffering endured by so many soldiers during the Civil War, as well as the comfort offered by Walt Whitman to hundreds of them.

Unlike Cunningham and thousands of other soldiers with limb amputations, thousands more survived the war with limb loss (Figures 2-6 through 2-8). Those who served the Union received prostheses from the federal government, and those who served the Confederacy received such technology from individual southern states. In both instances, however, many of the residual limbs produced by surgery were not conducive to fitting and wearing artificial limbs. Ragged tissue and protruding bones, or bones left close to the surface of the skin, caused immense pain and frustration for amputees who tried to use prostheses. Images of the period, in the form of photographs and paintings, fall short of conveying the difficulties faced by veterans with limb loss.

Figure 2-4. DW Bliss. At Armory Square Hospital, Whitman observed the work of Dr D Willard Bliss, the chief surgeon, whom Whitman described as "one of the best surgeons in the army." After the war, Bliss praised Whitman for his service to the nation's soldiers. "No one person who assisted in the hospitals during the war accomplished so much good to the soldier and for the Government as Mr. Whitman." Quotation from: Donaldson T. *Walt Whitman the Man*. New York, NY: Francis P Harper; 1896: 169.
Photograph: Courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. NCP 1858.

These challenges—combined with the sheer number of amputees produced by the war, and later by factories and railroad accidents—helped drive wartime and postwar entrepreneurialism in the nascent field of prosthetics.[15] In the 15 years before the war, 34 patents were issued for artificial limbs and assisting devices; during the 12 years from the beginning of the war to 1873, 133 patents for limbs were issued, nearly a 300% increase.[16] Among these was a patent held by James Edward Hanger, a Confederate soldier who, after losing his leg at the battle of Philippi, returned to his hometown of Churchville, Virginia. There, he developed what became known as the "Hanger limb" (Figure 2-9), which changed the so-called American leg by adding rubber bumpers to the ankle, and later a rubber foot, a forerunner of the solid-ankle, cushioned heel foot. Other patents of the day, often described prominently in advertising literature, included those held by George R Fuller of Rochester, New York (Figure 2-10), and AA Marks of New York, New York (Figure 2-11).

While Whitman exemplified individual philanthropy, contemporary voluntary aid organizations represented the philanthropy of communities in helping combat amputees acquire prostheses and other necessary aid, primarily because large numbers of combat casualties, and even larger numbers of sick soldiers, quickly overwhelmed the Army Medical Corps following the battle of Bull Run in 1861.[17,18] The acting Army Surgeon General, Colonel RC Wood, described the situation:

> The pressure upon the Medical Bureau has been very great and urgent; and though all the means at its disposal have been industriously used, much remains to be accomplished by directing the intelligent mind of the country to practical results connected with the comforts of the soldier by preventive and sanitary means. The Medical Bureau would, in my judgment, derive important and useful aid from the counsels and well-directed efforts of an intelligent and scientific commission, to be styled 'A Commission of Inquiry and Advice in respect of the Sanitary Interests of the United States Forces,' and acting in co-operation with the Bureau, in elaborating and applying such facts as might be elicited from the experience

a

Figure 2-5. (a) Lower thigh bone of Private Oscar Cunningham, 82nd Ohio Infantry, which is preserved today in the modern iteration of the Army Medical Museum, the National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. **(b) [***following page***]** Description of Cunningham's injury by Dr Bliss, from his surgeon's report, which accompanied Cunningham's remains when Bliss sent them to the Army Medical Museum for preservation.
Photographs: Courtesy of Anatomical Collections, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. Accession no. 1000755.

> and more extended observation of those connected with armies, with reference to the diet and hygiene of troops, and the organization of Military Hospitals, etc. This Commission is not intended to interfere with, but to strengthen the present organization, introducing and elaborating such improvements as the advanced stage of Medical Science might suggest.[19]

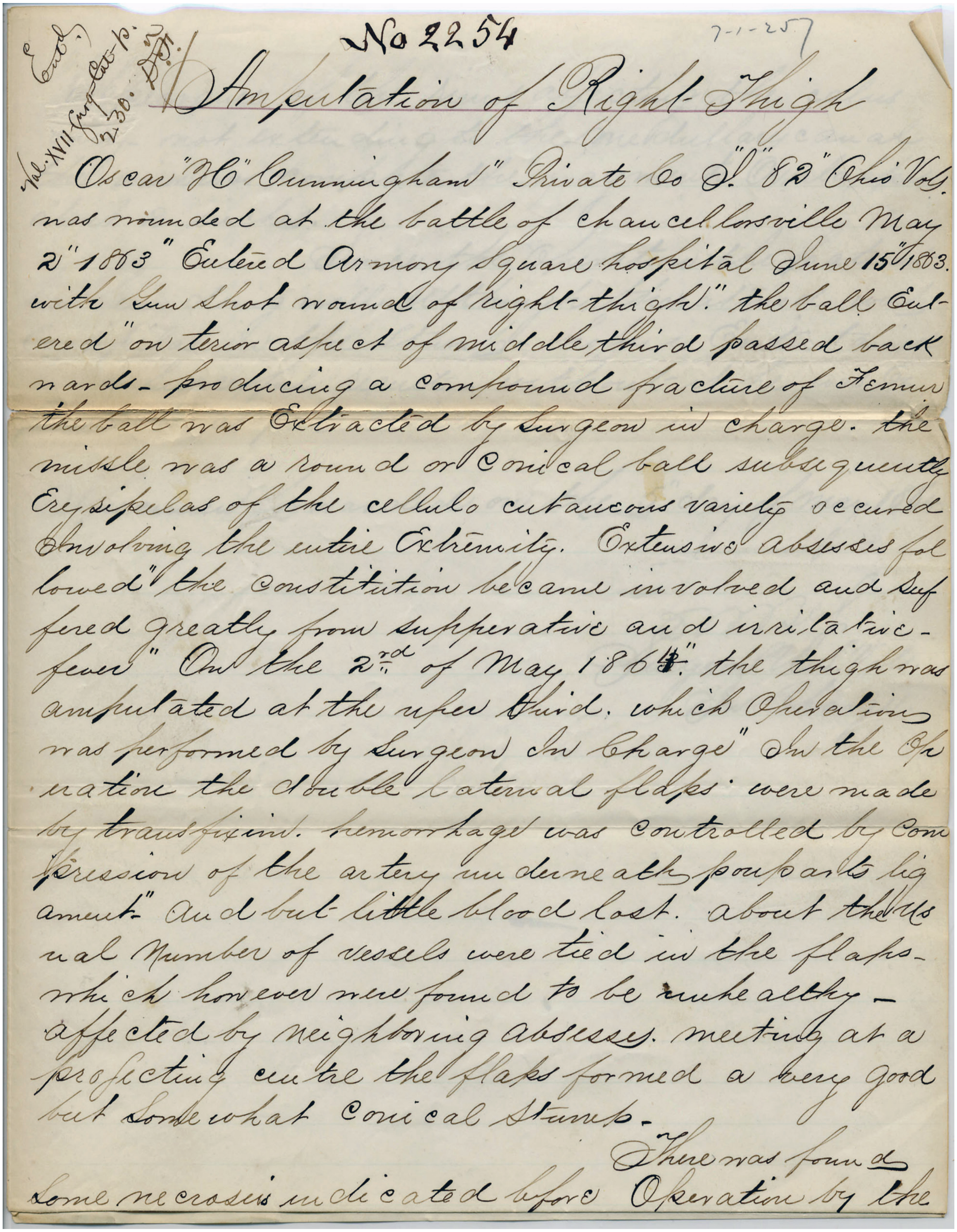
Thus was born the US Sanitary Commission, which, alongside the US Christian Commission, mobilized thousands of volunteers in support of Union soldiers (Figure 2-12).

Different approaches initially emerged among these groups, but they were eventually resolved as both volunteers and military officers settled into appreciating their respective contributions.[20] The medical department, quartermasters corps, and various civilian relief agencies cooperated to evacuate the wounded after the battle of Gettysburg. Finding 2,000 wounded men awaiting transportation at the nearby railroad, Dr Edward P Vollum, a medical inspector with the office of the Surgeon General, immediately began organizing their evacuation to hospitals in New York, New York; Baltimore, Maryland; and York, Pennsylvania. Vollum described the collaborative effort: "Before leaving, the wounded were fed and watered by the Sanitary Commission, and often hundreds of wounded, laid over for a night or part of the day, were attended and fed by the commission whose agents placed them in the cars. At Hanover Junction, they were again refreshed and fed by the Christian Commission, at Baltimore the agents of several benevolent societies distributed food bountifully to the wounded in the cars immediately on their arrival; and at Harrisburg, the commissary department had made arrangements for feeding any number likely to pass that way."[21]

By the end of the war, the Sanitary Commission had played a central role in establishing programs and policies to help reintegrate disabled soldiers into postwar, civilian society. One of its representatives described the commission's work:

> It seemed to us, that our pride, as a democratic nation ought to point . . . towards such a shaping of public opinion as would tend to reduce dependence among our returning soldiers to the lowest possible point; to quicken the local and family sense of responsibility, so as to make each neighborhood and each household, out of which a soldier had gone, and returned helpless and dependent, feel itself privileged and bound to take care of him . . . to encourage every community to do its utmost towards favoring the employment of returned soldiers, and especially, partially disabled ones in all light occupations . . . In short, we desired to favor in every way the proud and beneficent tendency of our vigorous American civilization, to heal its wounds by the first intention; to absorb the sick and wounded men into its ordinary life, providing for them through those domestic and neighborly sympathies, that local watchfulness and furtherance due to the weakness and wants of men well known to

b



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Amputation of Right Thigh

Oscar "H" Cunningham" Private Co I." 82" Ohio Vols. was wounded at the battle of chancellorsville May 2" 1863" Entered Armory Square hospital June 15th 1863. with Gun Shot wound of right thigh". the ball Entered "anterior aspect of middle third passed back wards- producing a compound fracture of Femur the ball was Extracted by Surgeon in charge. the missle was a round or Conical ball subsequently Erysipelas of the cellulo cutaneous variety occured Involving the entire Extremity. Extensive abscesses followed" the constitution became involved and suffered greatly from supperative and irritative- fever" On the 2nd of May 1864" the thigh was amputated at the uper third. which Operation was performed by Surgeon In Charge" In the Operation the double Lateral flaps were made by transfixion. hemorrhage was controlled by Compression of the artery underneath poupart's ligament" and but little blood lost. about the usual Number of vessels were tied in the flaps- which however were found to be unhealthy- affected by neighboring abscesses. meeting at a projecting centre the flaps formed a very good but somewhat conical Stump-

There was found

some necrosis indicated before Operation by the

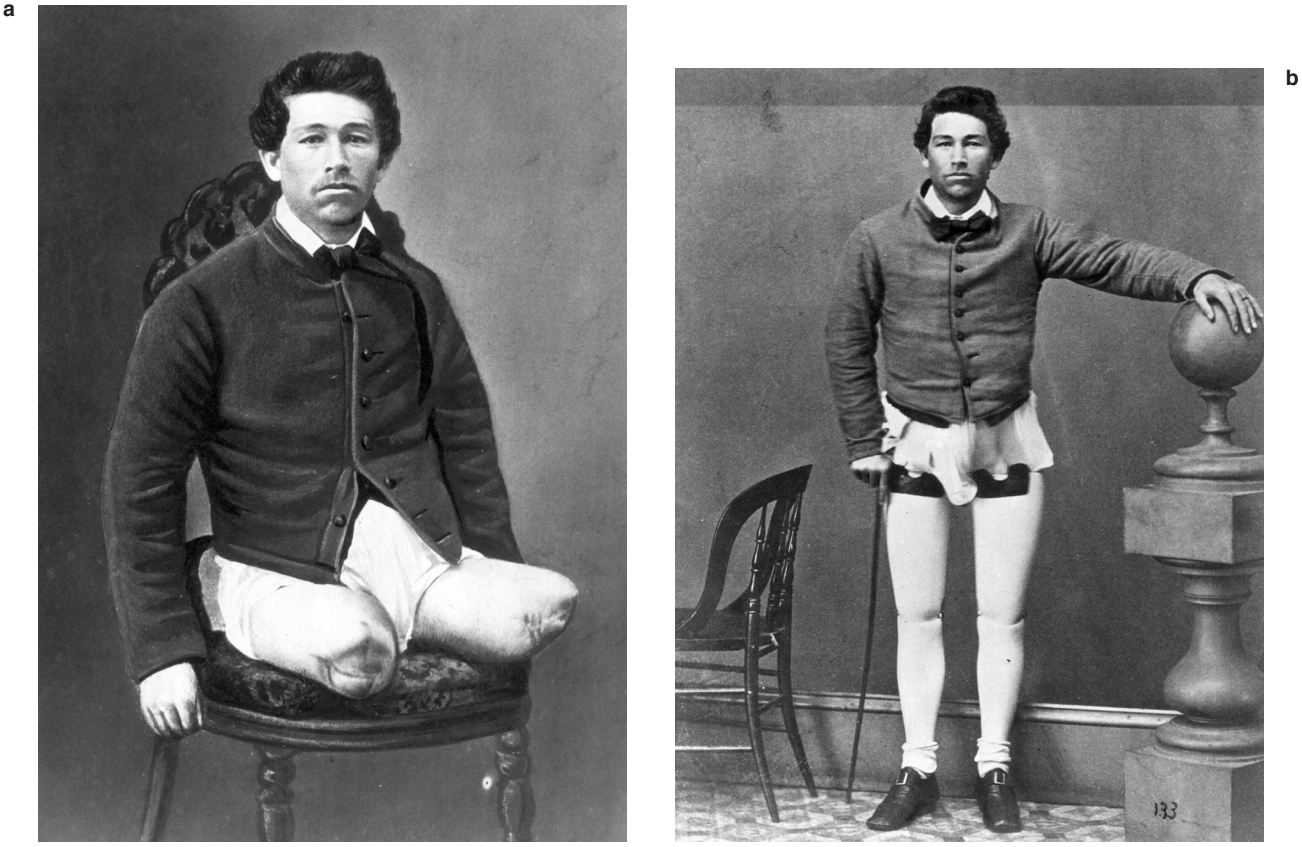


Figure 2-6. (a) Among the thousands who survived the US Civil War with limb loss was Private Columbus G Rush, Co C, 21st Georgia Regiment, who was wounded in an assault on Fort Sheridan, in the lines before Petersburg, Virginia, March 25, 1865, by a fragment of a shell. **(b)** Private Rush fitted with prostheses. Descriptive text on the reverse of this photo states that "with the aid of two canes he was enabled to walk about the wards of St. Luke's Hospital, New York, where he was transferred after amputation was completed at Lincoln Hospital, Washington, DC."
Photographs: Courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. SP 132 (a); SP 133 (b).

> their fellow citizens, and which is given without pride and received without humiliation; and this source of relief failing, then from the ordinary charities of the towns and counties from which they had sprung.[22]

More than rhetoric, these words represent an important opening chapter in the history of wartime and immediate postwar care for service members generally and those with limb amputations in particular.

WORLD WAR I

In May 1918 the French and Belgian ministries of war worked with their American and European counterparts to convene the second annual international conference and exhibition on the "after-care" of soldiers disabled in the ongoing war. Meeting in London, England, leading medical authorities, philanthropy representatives, labor leaders, and public figures exchanged views on two vital questions: (1) how could soldiers injured in the war be healed effectively, and (2) how could they be successfully reintegrated into civilian society after returning home? Officials at the previous conference (held in Paris in May 1917) had examined these questions in detail, but the military campaigns of 1917 made efforts to rehabilitate the wounded all the more vital for the welfare of the soldiers as well as their families, communities, and nations.

Philanthropy was a key component of this conference. Its face was in part that of John Galsworthy (Figure 2-13), the British writer (and later a 1932 Nobel laureate in literature), who since the war began had donated time, writing talents, and thousands of dollars

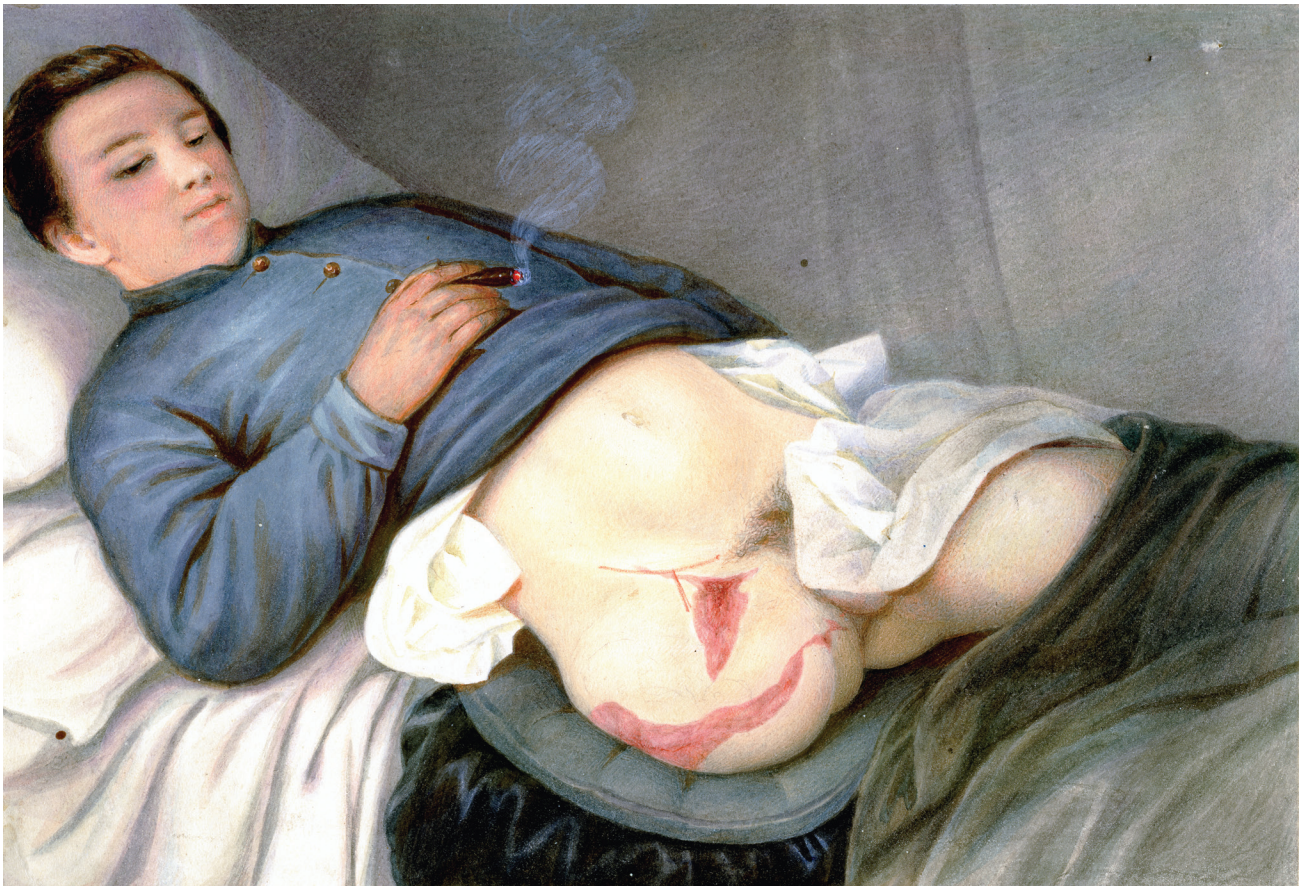


Figure 2-7. Another Civil War veteran with limb loss, Private Eben E Smith, Co A, 11th Maine, was wounded at Deep Bottom, Virginia, August 16, 1864, by a musket ball through the right leg. He survived the amputation of his right leg at the hip. Painting by Peter Baumgras.
Photograph: Courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. CWMI 006.

of his literary earnings to support what he called "the sacred work": the rehabilitation of servicemen severely injured physically or psychologically in battle.[23] In the introduction to the official conference proceedings, Galsworthy characterized its goals:

> In special hospitals orthopaedic [sic], paraplegic, neurasthenic, we shall give him back functional ability, solidity of nerve or lung. The flesh torn away, the lost sight, the broken ear-drum, the destroyed nerve, it is true we cannot give back; but we shall so re-create and fortify the rest of him that he shall leave hospital ready for a new career. Then we shall teach him how to treat the road of it, so that he fits again into the national life, becomes once more a workman with pride in his work, a stake in the country and the consciousness that, handicapped though he be, he runs the race level with his fellows and is by that so much the better man than they.[24]

These observations encapsulate the contemporary work being undertaken in Britain's network of military orthopaedic hospitals, approaches that eventually informed US systems of care for service members with limb loss.

The flagship of Britain's network was Shepherd's Bush Military Orthopaedic Hospital, located in London, where rehabilitation before discharge involved not only prosthetics but also therapeutic work. In the "curative workshops" of Shepherd's Bush and its counterpart institutions throughout the United Kingdom, medical staff used water, weights, and electricity in an effort to repair both body and mind. At the same time, they promoted another form of rehabilitative work as a way to prepare disabled soldiers for reentry into civilian life. Vocational labor, medical authorities held, helped to return soldiers to civilian life as healthy individuals, as able-bodied breadwinners, and

Figure 2-8. Another Civil War veteran with limb loss, Private Robert Fryer, Co G, 52nd New York, was wounded at Hatcher's Run, Virginia, and subsequently required amputation of his third, fourth, and fifth metacarpals.
Photograph: Courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. CP 1041.

as productive citizens.[25,26] In achieving this objective, philanthropic support was critical, and it came chiefly in the form of the Joint War Committee of the British Red Cross and Order of St John. In October 1916, this entity awarded an initial £1,000 grant to Shepherd's Bush. This sum was followed by a £10,000 grant in 1918. Supplementing these funds throughout the war were thousands of pounds donated directly by the public to both Shepherd's Bush and its associated facilities across the country.[27]

By 1918 comparable rehabilitation programs had emerged in the United States, chiefly as a result of contact between British and American medical personnel. Among the surgeons at Shepherd's Bush was Joel Goldthwait, a Harvard-trained orthopaedic surgeon from Boston General Hospital, who in late 1916 led a team of 2 dozen American orthopaedic surgeons in studying methods used by the Allies to heal combat-wounded soldiers. Goldthwait was particularly impressed with the organization and administration of the institution's curative workshops. The use of work as both treatment and retraining, Goldthwait believed during the closing months of 1917, could be implemented in the United States to help deal effectively with the increasing number of American disabled soldiers returning home, a number that eventually exceeded 4,000.

Goldthwait's recommendations to the surgeon general yielded plans to train teachers and medical aides to assist in the rehabilitation of America's service members disabled in the war. Called "reconstruction aides" (Figure 2-14), these individuals aimed to "to hasten the recovery of the patients . . . promote contentment and make the atmosphere of these hospitals such that the time spent in convalescence will pass most pleasantly because the minds and hands of the patients are properly occupied in profitable pursuits."[28] The work of these individuals received the support of most physicians and orthopaedic surgeons, and contributed greatly to the wartime and postwar expansion of the fields of occupational therapy and physical therapy.

A leading institution within America's network of rehabilitation centers was the Red Cross Institute for Crippled and Disabled Men in New York. In part through a $265,000 federal appropriation but largely through the generosity of wartime philanthropy directed to the Red Cross by the philanthropist Jeremiah Millbank, the institute offered a range of vocational training in constructing artificial limbs, welding, painting, business accounting, and mechanical drafting. It also included complementary departments of research, employment, surveys, and public education that, by October 1919, produced 7 million public-information pamphlets, sponsored 300 public lectures, and completed over 500 industrial surveys involving 1,500 factories and 100 trade associations, all to the end of empowering the disabled soldier to "win his own way to self-respect and self-support."[29,30]

Posters produced by the institution and displayed in its lobby, as well as in public spaces around New York City, incorporated images of physical reconstruction efforts being undertaken in US and Allied military hospitals (Figure 2-15). Conveying the philosophy of occupation as a vital means to helping the disabled reclaim participation in the fabric of postwar life, the images illustrate the historical roots of occupational therapy, physical therapy, and vocational rehabilitation (see Chapter 6).

INTERWAR PERIOD

Between World War I and World War II military "reconstruction centers" decreased in size substantially, and many disabled veterans found agencies like the Red Cross Institute ill-prepared to help them reenter civilian society. During this period Captain Robert S Marx (Figure 2-16), a wounded veteran, established an organization called Disabled American Veterans of the World War I. Under the leadership of Marx, the organization became a champion of the disabled veterans' cause. A year after he established the group, Marx called a national caucus of 250 disabled veterans, drawing together one of the first major associations to advocate for improved public services on behalf of disabled veterans. Disabled American Veterans remained active through World War II and continues its efforts today in cooperation with federal agencies and a constellation of other philanthropic organizations, including the American Legion, Paralyzed Veterans of America, and Vietnam Veterans of America Foundation.

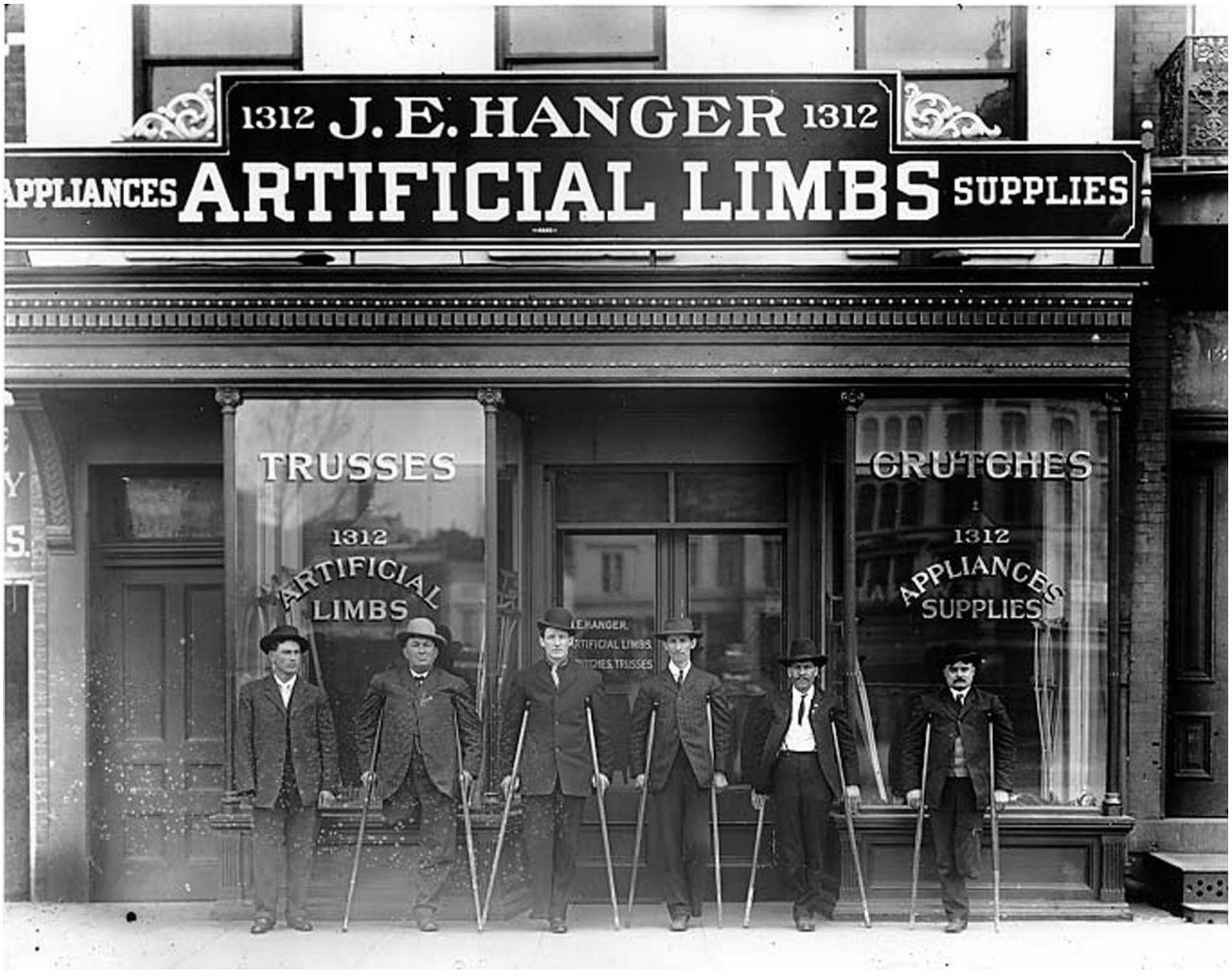


Figure 2-9. Six men, likely Civil War veterans, standing with the aid of their "Hanger limbs" near a JE Hanger storefront. Photograph commissioned by the JE Hanger Company. Undated but likely ca 1870–1880.
Photograph: Courtesy of Library of Congress, Washington, DC. CM Bell Collection of Glass Negatives.

WORLD WAR II AND THE IMMEDIATE POSTWAR ERA

By the Second World War, improvements in armor, aircraft, and radio communications that allowed for combined air/land operations tipped the scales in favor of offensive operations. Instead of the trench warfare that characterized World War I, combat tactics emphasized mobility. The new nature of combat changed the type of wounds sustained by soldiers. Lower extremity injuries involving bone and soft tissue represented 42% of the 20,747 battle casualties sustained by the Fifth US Army between August 1, 1944, and May 2, 1945, in contrast to 47% of casualties during the First World War. Upper extremity injuries accounted for 26% of the same sample during World War II, compared with 39% of World War I casualties.[31,32] Improvements in surgical technique, whole blood for transfusion, and antibiotics increased the chances of those wounded in the abdomen, while better methods for treating gunshot fractures, notably improved methods of traction and internal fixation of fractures, minimized the number of amputations performed.

Approximately 18,000 Americans sustained an amputation as a result of combat in World War II. However, the reason for loss of the limb had changed. One study concluded that 20% of the amputations resulted from arterial damage, while 80% were the result of "irreparable damage," usually from a land mine or artillery.[33] "When the limb was irretrievably shattered and mangled or was almost completely avulsed," reported Mather Cleveland, senior consultant in orthopaedic surgery in the European theater of operations during World War II, "the attending surgeon had no choice but to amputate it. In effect, a nearly complete traumatic amputation had already been performed, and it was his clear duty to complete it."[34] Germany's routine use of land mines as a defensive measure during the Italian campaign of 1944–1945 increased the number of US lower limb amputations. In 1943 land mines were responsible for approximately 15% of all amputations, but caused almost 36% in 1944–1945.[35]

By this period, rehabilitation of the combat-injured service member began in the combat zone. Military

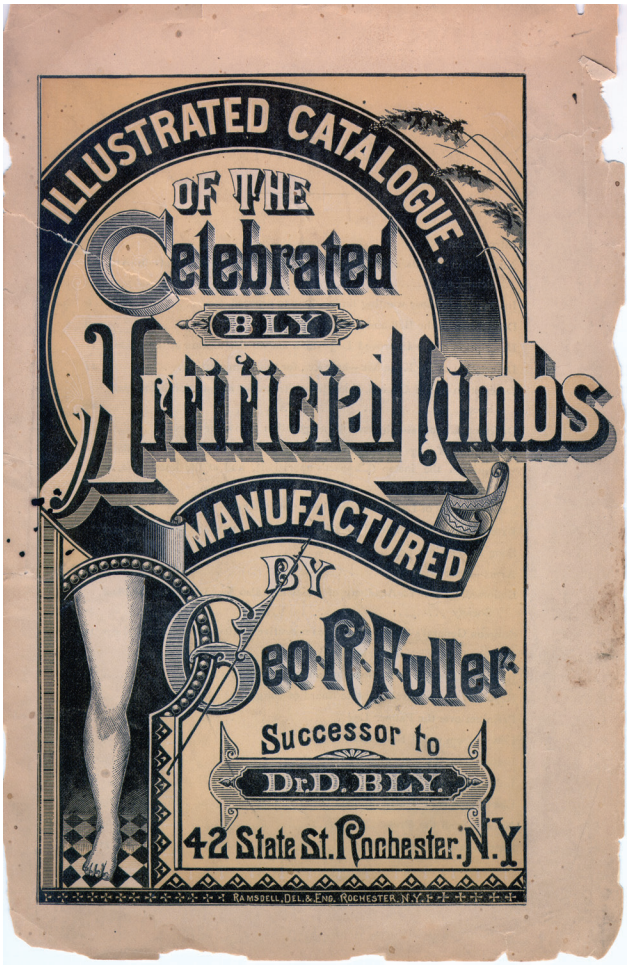


Figure 2-10. Advertising literature published by artificial limb manufacturer George R Fuller of Rochester, New York. Undated but likely 1870–1890.
Photograph: Courtesy of Warshaw Collection of Business Americana, National Museum of American History, Washington, DC.

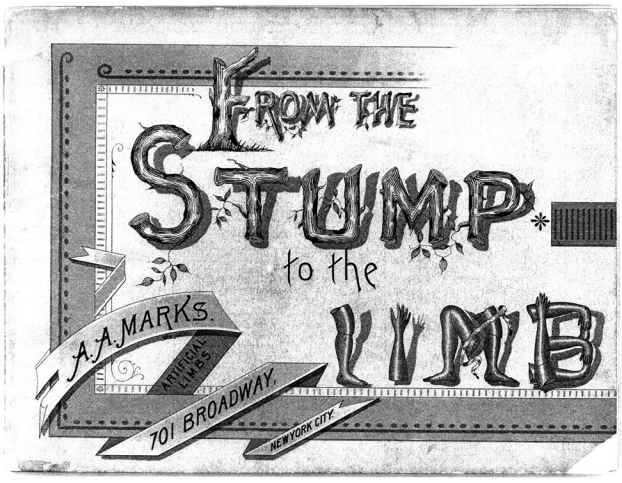


Figure 2-11. Advertising literature published by artificial limb manufacturer AA Marks of New York, New York. Undated but likely ca 1900.
Photograph: Courtesy of Warshaw Collection of Business Americana, National Museum of American History, Washington, DC.

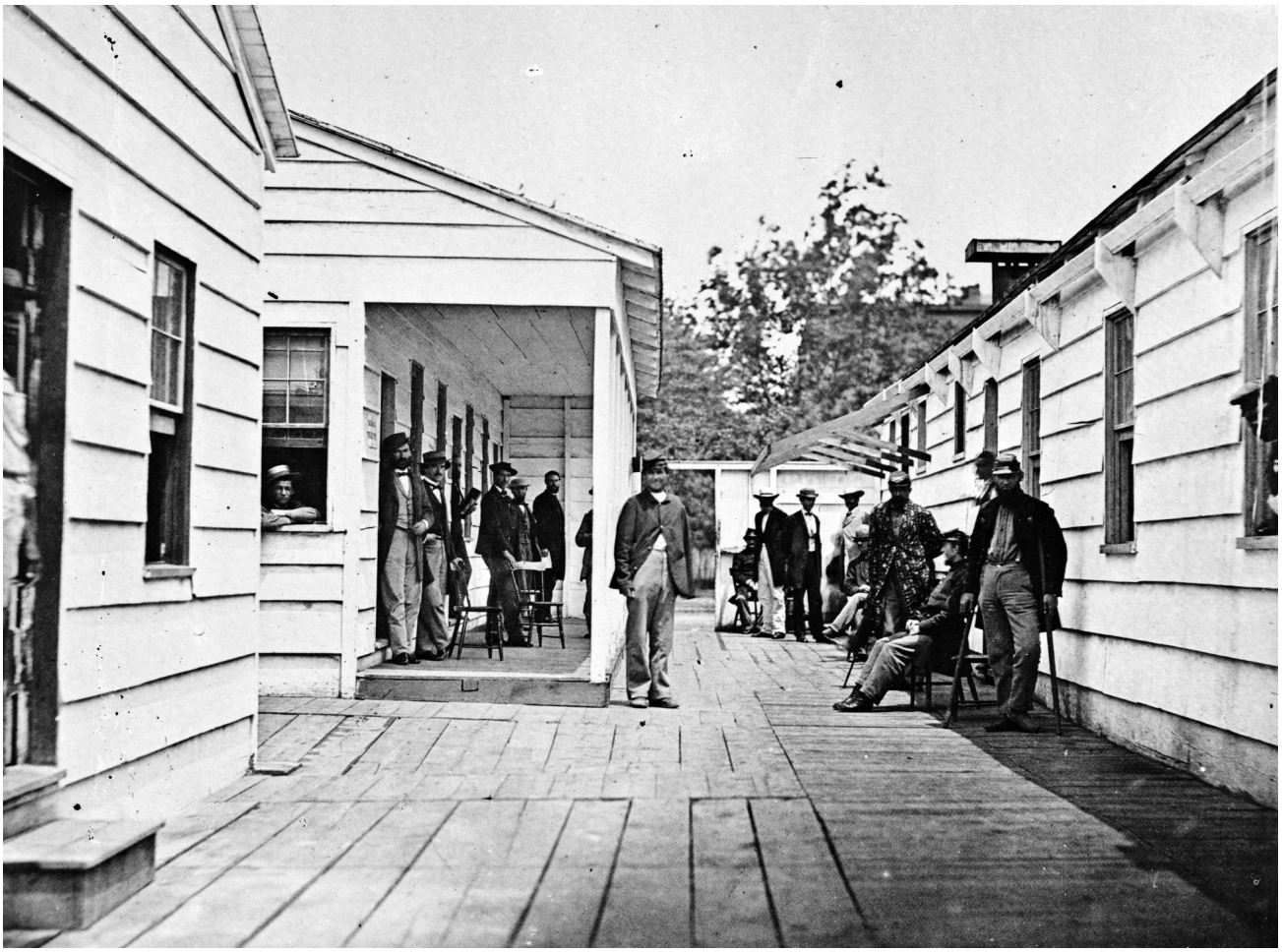


Figure 2-12. A US Sanitary Commission rest house in Washington, DC, where volunteers gathered in support of sick and wounded soldiers. Undated but likely 1863–1864.
Photograph: Courtesy of Prints and Photographs Division, Library of Congress, Washington, DC. Civil War Glass Negative Collection. LC-B811-1201.

medical authorities encouraged surgeons to focus on the whole patient as opposed to a single procedure. Circular letter no. 46, issued in August 1944 by Headquarters, North African Theater of Operations, contained details of this protocol, emphasizing "that casualties who required amputation should be told before operation, whenever their condition permitted, why this procedure was necessary. It was also suggested that, as soon as the patient was surgically comfortable and mentally receptive, an interview with a psychiatrist or chaplain might be useful. These instructions were based on the fact that about 1 in every 5 patients could be expected to exhibit psychic reactions, often depressive in type, a few days after operation." Additionally, the circular indicated that "particular attention was to be paid in this and other interviews to what the soldier might reasonably expect in the way of aid. He was to be told of the amputation centers which had been established in the Zone of Interior, the prosthetic appliances which were available, and the economic and other aid which he could be assured of receiving. Fortification of this kind before the patient became the target of sympathetic family and friends," the circular letter pointed out, "might tip the scales in favor of rehabilitation, while its omission might result in lifelong disability and resentment."[36p328]

As in previous conflicts, philanthropy played an important role in the rehabilitation of World War II service members who suffered limb amputations. Dr Howard Rusk (Figure 2-17) embraced the "whole patient" concept in his techniques to help injured Air Force personnel. As he described the first Air Force rehabilitation center at Pawling, New York: "I guess you might describe [it] as a combination of a hospital,

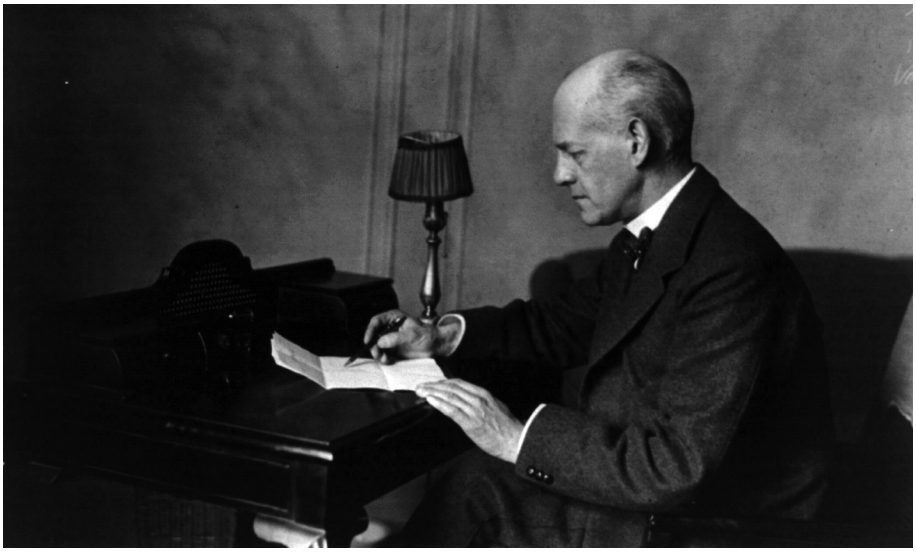


Figure 2-13. John Galsworthy (1867–1933), the British writer and later Nobel laureate who donated his time, writing talents, and thousands of dollars of literary earnings to support what he called "the sacred work": the rehabilitation of servicemen who were severely injured physically and psychologically in World War I. Photograph dated 1919.
Photograph: Courtesy of Prints and Photographs Division, Library of Congress, Washington, DC. George Grantham Bain Collection, Biography file.

Figure 2-14. Occupational therapy at Walter Reed Hospital during the First World War. A reconstruction aide supervises the work of one soldier while her colleague observes the group.
Photograph: Courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. Reeve 4272.

a country club, a school, a farm, a vocational training center, a resort, and a little bit of home as well. The discipline was minimal and the program informal. Old regular Army people would have shuddered, but fortunately General Arnold didn't have the traditional Army man's outlook [as he] reaffirmed his full support of the program and his conviction that it would prove its worth, not only by returning men to healthy lives, but by returning many of them to duty."[36] Rusk's approach helped establish many of the principles of rehabilitation later incorporated into the programs of the Institute of Rehabilitation at New York University, an institution that had a large impact nationally and internationally on the field.[37]

The efforts of Major General Norman Thomas Kirk (Figure 2-18) were also instrumental in the care of America's combat amputees during and after World War II. Based on his experiences in World War I, when he established himself chiefly at Walter Reed as a leading authority on amputations, Kirk helped establish multidisciplinary amputee centers around the country to provide up-to-date surgical, medical, prosthetic, and rehabilitative care. Later, as Army Surgeon General, Kirk asked the National Research Council to set up a committee on prosthetic devices to provide leadership and coordination of the emerging federal programs in the Army Surgeon General's Office of Scientific Research and Development and Veterans Administration.[38] According to historians and rehabilitation experts alike, these initiatives were dramatically successful, helping to make 1945 to 1975 one of the most productive periods in US prosthetics and rehabilitation research, benefiting both combat and civilian amputees.[39–41]

Philanthropy also joined military medicine through the activities of Dr Bernard Baruch (Figure 2-19), who funded the Baruch Committee on Physical Medicine in 1943. Chaired by Dr Ray Lyman Wilbur and composed of subcommittees on education, teaching, research, public relations, rehabilitation, hydrology, occupational therapy, prevention, and body mechanics, this group aimed to expand the medical specialty of physical medicine and rehabilitation and maximize its contribution to the care of injured soldiers and sailors. Baruch's generosity advanced the field of physical medicine as well as rehabilitative care for service members with limb amputations, paving the way to recognition that amputations are lifelong injuries, with sequelae requiring adequate support from federal agencies like the Veterans Administration as well as the philanthropic societies that are equally invested in the successful rehabilitation of veterans with disability.

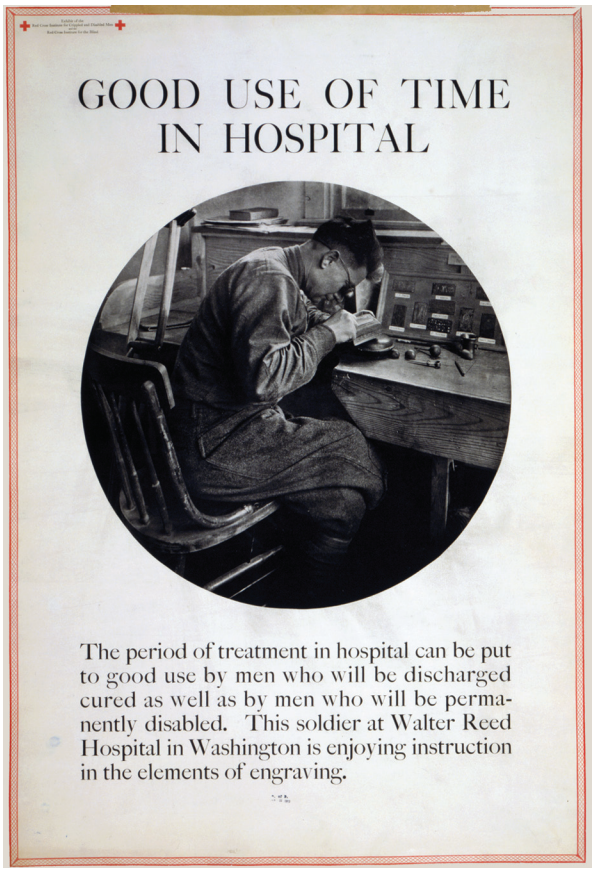
KOREA AND VIETNAM

The Korean conflict was marked by extreme mobility during the 1st year of the war as North Korean and United Nations troops engaged along the Korean Peninsula. As the forces counterbalanced each other, 2 years of trench warfare followed. During this period medical authorities applied lessons learned from World War II in the form of helicopter ambulances and the mobile Army surgical hospital to help ensure that seriously wounded soldiers received prompt medical care and better odds of survival. The issuance of soft body armor complemented this effort. Of the final 7,200 United Nations soldiers wounded in Korea, 56% sustained injury to their extremities. As in the Second World War, surgeons performed amputations primarily on "extremities hopelessly destroyed by trauma or infection or both."[42] The number of cases requiring amputation decreased as a result of improved vascular surgery. Of the 16,890 simple and compound fractures sustained by soldiers during the war, only 1,477 amputations were performed, in addition to 1,120 traumatic amputations. Over 70% of the wounds resulting in amputations were caused by explosive projectiles, grenades, and land mines.[43] During the Second World War, one study found that 50% of 2,471 arterial wounds resulted in amputation. Vascular surgery was attempted in 81 cases with a failure (and subsequent amputation) rate of 36%. A study during the Korean conflict reported that only 26 (13%) of the 194 vascular repairs failed, resulting in amputation.[44]

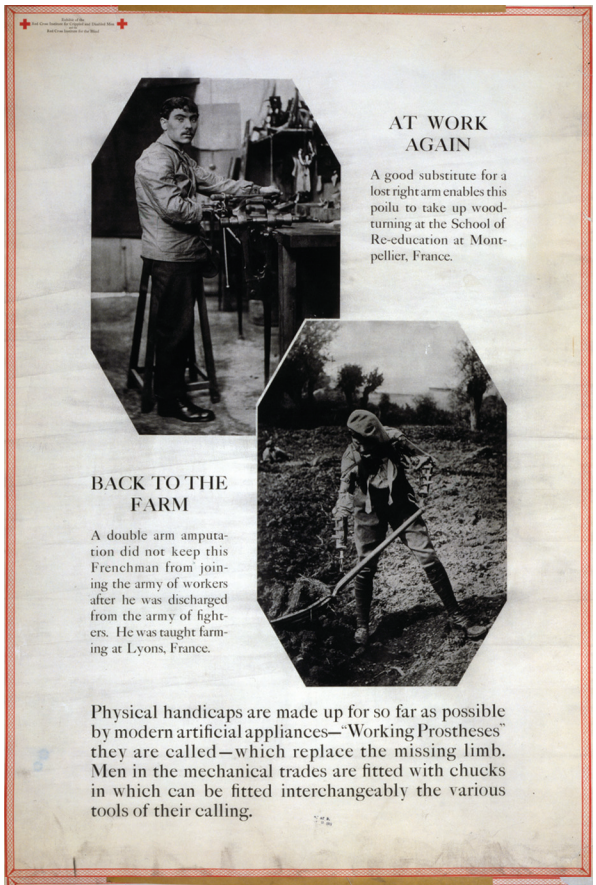
The Vietnam War brought a different style of warfare. Lighter weapons increased the amount of firepower that could be carried by infantry. New rifles such as the Colt M-16 and the Kalashnikov AK-47 fired high-velocity bullets that pulverized bone. US forces frequently operated from fixed firebases and sent patrols to monitor surrounding territory, and rather than risk direct contact, the Viet Cong preferred to deploy a wide variety of land mines, booby traps, and punji sticks along major paths and patrol routes. These weapons increased crippling wounds to the lower extremities by 300% compared to World War II and 70% compared to Korea. Over 5,200 US soldiers lost limbs in Vietnam.[9,10,45]

During the period ca 1950 to 1975 service members with limb loss had a much higher survival rate than in World War II and previous wars primarily because of improved resuscitation and surgical repair of damaged blood vessels, as well as better evacuation of soldiers from the frontlines to better equipped and more sanitary care facilities. However, as Colonel

a


GOOD USE OF TIME
IN HOSPITAL
The period of treatment in hospital can be put to good use by men who will be discharged cured as well as by men who will be permanently disabled. This soldier at Walter Reed Hospital in Washington is enjoying instruction in the elements of engraving.

b


AT WORK AGAIN
A good substitute for a lost right arm enables this poilu to take up wood-turning at the School of Re-education at Montpellier, France.
BACK TO THE FARM
A double arm amputation did not keep this Frenchman from joining the army of workers after he was discharged from the army of fighters. He was taught farming at Lyons, France.
Physical handicaps are made up for so far as possible by modern artificial appliances—"Working Prostheses" they are called—which replace the missing limb. Men in the mechanical trades are fitted with chucks in which can be fitted interchangeably the various tools of their calling.

c


FIRST STEPS TO USEFULNESS
Simple designing while still in bed
An American soldier begins again to take an interest in life
Bedside and ward occupations serve to interest wounded men and keep their minds active and off their own troubles. Occupation is also one of the best curative agents at the command of the physician, and in most cases it does much to expedite recovery. Gone are the old days when men lay for months in a hospital bed gazing at the ceiling and brooding about the future.

d

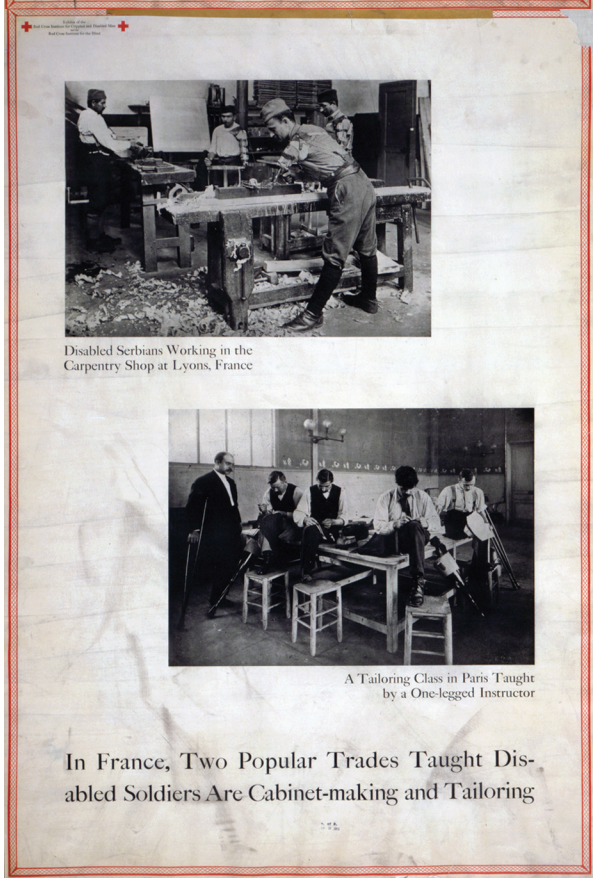

Disabled Serbians Working in the Carpentry Shop at Lyons, France
A Tailoring Class in Paris Taught by a One-legged Instructor
In France, Two Popular Trades Taught Disabled Soldiers Are Cabinet-making and Tailoring

Figure 2-15 *(preceding page).* Wartime exhibition posters developed and used by the Red Cross Institute for Crippled and Disabled Men and the Red Cross Institute for the Blind during World War I. **(a)** A soldier recovering from war wounds at Walter Reed Hospital and learning the craft of engraving. **(b)** Disabled French soldiers using "working prostheses" to perform manual labor in a woodworking shop and on a farm. **(c)** Two scenes of men in hospitals recovering from war wounds through occupational therapy. **(d)** Two scenes in which disabled French and Serbian soldiers are being taught useful skills to enable them to find employment upon discharge from military service.
Photographs: Courtesy of Prints and Photographs Division, Library of Congress, Washington, DC. POS – WWI – US, no. 43 (a); no. 30 (b); no. 44 (c); no. 46 (d).

Paul W Brown observed in his history of Vietnam-era amputee care that until the early years of Vietnam, the approach to wartime amputee care had changed little from that of World Wars I and II and the Korean War: heal the stump, fit it with a prosthesis, train the patient in its use, and discharge him to civilian life. Although advances in prosthetics and orthotics contributed to better function, and the addition of vocational counseling and driver education to some degree rendered the adjustment to civilian life easier, progress in programs to help amputees live lives as normal as possible had not been significant. All management programs had been directed toward what was lost, not toward what had been retained. Only when the number of amputees began climbing rapidly in 1967 were methods explored to expand their total rehabilitation through motivational therapeutic programs. Such an initiative was described by Dr Timothy Dillingham in the previous edition of this textbook:

> a unique aspect of care at the Fitzsimons General Hospital was the amputee skiing program. Over 100 amputees treated during 1968 and 1969 learned to ski using adaptive aids. These casualties gained confidence and an enhanced sense that even with their disabilities they could find challenges and enjoyment through skiing and other recreational activities. [One contemporary] described the incredible psychological trauma involved with amputation, and the Fitzsimons program stressed treatment of the whole

Figure 2-16. Judge Robert S Marx, National Commander, Disabled American Veterans of the World War, ca 1921.
Photograph: Courtesy of Library of Congress, Washington, DC. National Photo Company Collection, LC-F8-14813.

Figure 2-17. Dr Howard Rusk, who embraced the "whole patient" in his techniques to help injured Air Force personnel during World War II. Photograph ca 1950.
Photograph: Courtesy of History of Medicine Division, National Library of Medicine, Bethesda, Maryland.

Figure 2-18. Norman Kirk, who, during World War II, used his experiences in World War I to help establish multidisciplinary amputee centers around the country to provide up-to-date surgical, medical, prosthetic, and rehabilitative care.
Photograph: Courtesy of Otis Historical Archives, National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, DC. Medical Illustration Service Library. MIS57-07732-33.

Figure 2-19. Bernard Baruch, who generously funded the Baruch Committee on Physical Medicine in 1943.
Photograph: Courtesy of Library of Congress, Washington, DC. George Grantham Bain Collection, LC-B2-4110-12.

> individual with the goal of returning the soldier to an optimal level of function. The recreational activities had a positive impact on the mental well being of the soldier and were a vital part of the rehabilitation plan.[46]

The roots of rehabilitative athletics can be traced in part to the years immediately following World War II, when the English neurologist Sir Ludwig Guttmann organized a sports competition for veterans with spinal cord injuries. This competition eventually became known as the Stoke Mandeville Games. In 1952 competitors from the Netherlands took part in these games, giving an international character to the initiative and paving the way to the first Paralymic Games, held in Rome, Italy, in 1960.[47] Today the Paralympics are one of the greatest influences on the development of prostheses and their use by people with amputations. Whereas the 1960 games involved 400 athletes from 23 countries and limited, if any, media coverage or support by the prosthetics field, the Athens Games of 2004 involved 3,806 athletes from 136 countries competing under the eye of major media coverage—broadcast by the CBS television network and sponsored by Getty Images among other companies—as well as corporate support of Visa, Otto Bock HealthCare, Samsung, and Edelman, the world's largest independent public relations firm.[48] The Paralymics have also become one of the largest and most important showcases of the physical potential of people with disabilities and the power of prosthetic technology. In conjunction with affiliated nonprofit organizations, including the Challenged Athletes Foundation, Disabled Sports USA, and Orthotic and Prosthetic Assistance Fund (among many others described in Chapter 25), and with federal initiatives such as the National Veterans Winter Sports Clinic and National Disabled Veterans Wheelchair Games, both sponsored by the Department of Veterans Affairs and Paralyzed Veterans of America, the Paralympics help promote opportunities for disabled veterans and others to participate in

competitive sports, at local, national, and international levels. And as an opportunity for the prosthetic industry to sponsor individual athletes as well as entire teams, the Paralympics help advance developments in prosthetic design and function. Today, dozens if not hundreds of disability-focused nonprofit organizations complement the mission of the Paralympics, which, in addition to providing athletic opportunities and advancing the field, expands public awareness of ability despite limb loss. The charitable work of these organizations is a current chapter in the history of philanthropy and military medical care working in tandem toward the rehabilitation of the service members with limb amputations.

CURRENT CONFLICTS

Current conflicts have reversed this declining trend of amputations among wounded service members, and recent studies have shown that major limb amputation rates for the current US engagements are similar to those of previous conflicts.[49] The nature of combat has changed as sensors, precision-guided munitions, and robotic weapons have made military formations of the opposing forces, even those taking advantage of the civilian population for cover and concealment, increasingly vulnerable. Suicide bombers and mechanical ambushes have proven to be a deadly tactic against a highly mobile military force. The land mine of World War II and punji stick of the Vietnam War have given way to the improvised explosive device. To treat the wounds caused by these new weapons military surgeons are using new medical technology such as hemostatic bandages that stop massive bleeding and miniaturized resuscitation devices that place the technology of an intensive care unit near or on the frontlines of battle. Emerging prosthetic technology holds greater promise than ever before. But so too does the altruism of private citizens and civilian organizations involved in providing rehabilitation and support programs to service members with limb loss and other injuries, and to their families and loved ones.

SUMMARY

If history is any guide, the partnership of US military medicine and the generosity of citizens will take on new forms as researchers follow the "roadmap for future research" described in Chapter 28, and assess its outcomes both for individuals with amputations and those with polytrauma and related conditions of 21st century warfare. History helps put this research and practice into perspective, showing that rehabilitation should involve critical thinking not only about medicine but also about the role of society in caring for military service members with limb amputations and in defining renewed occupations, social participation, and overall health of service members despite their physical and psychological challenges. This role is reflected by the diversity of professionals on the rehabilitation team, including anthropologists, economists, demographers, historians, psychologists, sociologists, and statisticians, and the current and potential future contributions of social scientists to rehabilitation research and to the reintegration into society of men and women who have sustained severe injury in service to the nation.

The history surveyed here is valuable in much the same way as taking a medical history is central to care of an individual with limb loss. That process involves discovery of the past, or as one physician described it, "acceptance of the truth that to care for the patient today, the patient of the past must be examined too."[50] This history reveals how today's service members with limb amputations receive care within systems with roots as much in past medical lessons learned as in the altruism of individuals and communities who care deeply about the rehabilitation of these veterans and their renewed health and participation in postwar, civilian society.

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