

A Tradition of National Service in Times of Crisis

AMERICAN SURGEONS have served in their country's 20th-century wars with dedication, courage, and skill. Civilian surgeons accepted military commissions and were deployed overseas. They disrupted their careers and were separated from their families; a few became casualties. Contemporary American surgeons witnessed the devastation of the September 11, 2001, attacks and realized that in the terrorist wars of the 21st century, the battlefields will include the homeland and the casualties may be large numbers of civilians. Surgeons ponder how best to respond to this new crisis. Nearly a century ago, George W. Crile, Harvey Cushing, and George E. Brewer were surgeons who responded to the national crisis of their time. Contemporary surgeons can learn from their example.

In the first decade of the 20th century, Crile, Cushing, and Brewer emerged as leaders in American surgery. They were published scholars and respected surgeons. In 1903, they were cofounders of the influential Society of Clinical Surgery.¹ Members were practical surgeons whose goal was to learn from one another technical details that improved their ability to safely perform and teach surgery. By 1912, Crile, Cushing, and Brewer as academic leaders called for American surgeons to comply with high standards of education and training. They were early and stalwart supporters of the campaign in 1912 and 1913 to establish a College of Surgeons.² On the eve of the First World War, these men could not have anticipated that their lives would soon be disrupted by events in Europe.

In 1914, George W. Crile was 48 years old and Chief of Surgery at Lakeside Hospital in Cleveland, Ohio.³ Raised on an Ohio farm, Crile had received 2 years of rudimentary medical education at the College of Wooster, a proprietary medical school in Cleveland. He secured a year of clinical training as a surgical intern in a Cleveland hospital. Largely self-taught, the inquisitive Crile felt challenged by his inability to effectively treat his severely injured patients. He focused his interest on shock and performed experiments to determine whether he could prevent the irreversible decline to death. In 1888 Crile published his first article, and that began his half-century career of surgical scholarship.⁴ By 1914 Crile had authored books and multiple articles, including, in 1909, the first paper on blood transfusion presented to the American Surgical Association.⁵

In 1914 the 46-year-old Harvey Cushing had been recently appointed the first Chief of Surgery at the Peter Bent Brigham Hospital in Boston, Mass.⁶ Cushing, like Crile, was born in Ohio; however, Cushing's educa-

tional pedigree was superior. Cushing secured an undergraduate degree from Yale University, New Haven, Conn, and graduated from Harvard Medical School, Boston, in 1895 with the first class to complete a 4-year curriculum. Five years later, Cushing was chief surgery resident at Johns Hopkins Hospital, Baltimore, Md, and thus joined an elite group who were trained by William Stewart Halstead. Cushing started the 20th century with study in Europe. In Berne, Switzerland, he performed experiments that were the basis for his published description of a physiologic reflex in which hypertension and bradycardia were the responses to increased intracranial pressure. Returning to Johns Hopkins as faculty, Cushing began his academic career. He was a confident surgeon with a meticulous operative technique, and with bold determination, he developed techniques that enabled him to safely perform a craniotomy. Cushing's scholarship largely established neurological surgery as a specialty in the first decade of the 20th century.⁶

In 1914, George E. Brewer was 51 years old and Chief of Surgery at Presbyterian Hospital in New York, NY.⁷ Brewer graduated from Harvard Medical School in 1885 and soon joined the faculty of Columbia University, New York. In 1914 he was Chairman of the Department of Surgery in the College of Physicians and Surgeons of Columbia University. Brewer was an accomplished surgeon and the sole author of a popular surgical textbook in which he recommended treatments for a wide range of injuries.⁸ In 1912 Brewer was on the organizing committee that wrote the charter for the American College of Surgeons.²

In the summer of 1914, peace in Europe vanished. Gavrilo Princip, a Serbian terrorist, was determined to disrupt the status quo. He planned to assassinate Archduke Franz Ferdinand, heir to the throne that ruled the Austro-Hungarian Empire. On June 28, 1914, in Sarajevo, the resolute 19-year-old Princip fired his small revolver into the royal limousine. The bullet struck the Archduke in his neck. He immediately had hemoptysis and was dead within minutes. A diplomatic confrontation ensued between Austro-Hungary and Serbia. Duplicious and incompetent statesmen in the capitals throughout Europe escalated the assassination in the Balkans into the horrific tragedy of World War I. Within 1 month of the Archduke's murder, millions of military reservists had been mobilized. The German Kaiser, Wilhelm II, committed Germany to support Austro-Hungary. France and Czarist Russia entered the war to defend Serbia. Over the next 4 years, 10 million combatants would die, and countless casualties would need surgical care.



Figure 1. Members of the Presbyterian Hospital Unit in the early summer of 1917 at Etretat, France. In the second row seated on the left is George E. Brewer. To his left are Maj L. L. Hopwood (Commanding Officer), Maj Edward Welles (Adjutant), and William Darrach. Reprinted from Lamb.⁷ Copyright 1955, Columbia University Press.

On August 2, 1914, the German army invaded neutral Belgium. In response the British government complied with the 1839 Treaty of London that guaranteed a neutral Belgium. Britain declared war on Germany and dispatched the British Expeditionary Force (BEF) to France. Within 4 weeks the Kaiser's army overwhelmed Belgian resistance, and by mid-September German divisions were outside of Paris, France. British and French armies repulsed the Germans in the First Battle of the Marne. Troops quickly learned that in modern war their survival depended on entrenchments. By the winter of 1914 to 1915, the stalemate of the Western Front had begun. The trench lines of opposing armies formed a frontier from the North Sea to Switzerland. Those who climbed out and entered no-man's-land courted death.

At the start of the war, experts had warned in British medical journals that infectious diseases posed the greatest threat to troops. After 2 months of fighting in northwest France, British surgeons realized that combatants in modern war died principally from wounds. Artillery crews could rapidly and accurately fire a breech-loading cannon that enveloped advancing troops with showers of shrapnel. Furthermore, the effective killing capacity of the new Maxim machine gun had been demonstrated. Two men could deliver a stream of bullets that decimated hundreds of attacking troops. During the first weeks of war, thousands of wounded French soldiers were evacuated to Paris. Hospitals were overwhelmed, and many wounded died never having been treated. In the fall of 1914, the American Ambassador to Paris, Myron T. Herrick, proposed a humanitarian gesture.⁹ American funds were solicited to be used to equip new surgical hospitals near Paris. Herrick cabled to his friend George Crile and asked how these hospitals could be staffed with competent medical professionals. Crile suggested that faculty surgeons in American universities should be invited to recruit volunteers among existing staff in their hospitals. As civilian volunteers, they would serve a 3-month tour in France. Crile quickly organized personnel at Cleveland's Lakeside Hospital into a volunteer unit. Crile led the first unit, which arrived in January 1915, at

the American Ambulance, a school converted into a hospital and located in Neuilly-sur-Seine, a Parisian suburb. The Lakeside unit was replaced in March 1915 by the Brigham unit from Boston, led by Harvey Cushing. George E. Brewer, leading a group of volunteers from New York's Presbyterian Hospital, served in the summer of 1915 as Chief of Surgery at another volunteer hospital at Juilly, northwest of Meaux. Back in America, the 3 professors reported that multiple wounds were the surgical challenge produced by the weapons of modern war. They urged America's surgeons to prepare. Each of them accepted a commission as majors in the reserves of the US Army Medical Corps. At their civilian hospitals they organized military reserve units composed of doctors, nurses, orderlies, and a few administrative personnel.

For Crile, Cushing, and Brewer, the call to service came in the early spring of 1917. Unrestricted German submarine warfare in the North Atlantic provoked President Woodrow Wilson and Congress to declare war against Germany on April 6, 1917. The US Army was small, and it would be a year before the American Expeditionary Force (AEF) would be ready to fight on the Western Front. Regardless, 3 weeks after the Senate voted for war, the Surgeon General of the US Army, William C. Gorgas, wired Crile, Cushing, and Brewer and asked when their medical reserve units could be ready. A tribute to their leadership is the fact that they, as active duty officers in AEF's Medical Corps, arrived in London, England, in the end of May 1917 leading fully capable university-based surgical units. The British were astonished and grateful. After 3 years of war, the British Medical Corps was depleted through casualties and exhaustion; these new American allies were welcome reinforcements.

The British immediately dispatched the 3 American university units to France. The Americans relieved British personnel serving at 3 base hospitals tasked to support the BEF. Base hospitals were large and provided medical and surgical services equivalent to those services available in hospitals in England. Base hospitals were located more than 100 km from the front lines, and wounded soldiers had to survive many hours of evacuation from the trenches. Deep wounds were a common medical problem, and, because many casualties had delayed surgical treatment, devitalized tissues set the stage for infection. Cushing's group was assigned to Base Hospital No. 11, located near the beach at Camiers and 24 km south of Boulogne in the Pas-de-Calais. Crile's unit was assigned to Base Hospital No. 9 in the city of Rouen near the river Seine. Brewer's group was assigned to Base Hospital No. 2 at Etretat, north of Le Havre, where beach resort hotels had been converted into hospitals (**Figure 1**). Members of these medical units were destined to be the first American combat casualties in Europe.

Crile, Cushing, and Brewer arrived in France as Sir Douglas Haig, Commanding General of the BEF, was planning another push. The Third Battle of Ypres was named for the city in Flanders, Belgium, where in the summer of 1917 opposing trenches of the Western Front swerved to the east forming a salient (**Figure 2**). Haig intended to break out from Ypres, recapture Belgium, and thereby end the 3-year stalemate on the Western Front. Instead, during 4 months of fighting the BEF advanced over 7 km of

rain-drenched terrain at a cost of one quarter of a million casualties among British, Canadian, Australian, and New Zealand troops. Starting the last day of July, the long battle ended November 10, 1917, when Haig's last reserves captured Passchendaele, Belgium, described by Cushing as a "smudge of ruins, which had been the village."^{9(p250)}

In early July 1917, the British asked surgeons at the base hospitals to volunteer to lead 4-person surgical teams. Before the attack, these teams would be deployed close to the Western Front at Casualty Clearing Stations (CCSs). Teams consisted of a surgeon, an anesthetist, a surgical nurse, and an orderly. Crile, Cushing, and Brewer volunteered, and by the end of July they were at CCSs, which consisted of clusters of canvas tents and corrugated iron huts. Although the facilities were austere, the proximity of CCSs to the fighting meant that surgical teams could provide timely, definitive care. Brewer's team was assigned to CCS No. 61, which the British named Dosinghem, located 13 km northeast of the Ypres salient and 5 km north of Poperinghe. A second surgical team from Presbyterian Hospital unit was with Brewer, led by 40-year-old William Darrach, an experienced trauma surgeon who had worked at New York's Bellevue Hospital.⁷ Cushing's team was ordered to CCS No. 46, which the British named Mendinghem and was situated 3 km east of Dosinghem. Cushing intended to specialize in "head" cases⁹ (Figure 3). Crile's team was assigned to CCS No. 17 at Rémy Siding, also called Lijssenthoek, which was less than 2 km south-east of Poperinghe.³ The sites in Flanders of these CCSs can still be identified today; next to each CCS was a cemetery, made necessary in the summer of 1917 by the need to rapidly bury the many dead. The military cemeteries Dosinghem, Mendinghem, and Lijssenthoek have remained hallowed grounds for nearly a century.

After weeks of ineffectual artillery bombardment, the BEF attacked in a downpour on July 31, 1917. British and Commonwealth troops along the Ypres salient were soon mired in the mud of no-man's-land as the German's delivered devastating artillery and machine gun fire. Through August and September, the surgical teams at the CCSs worked at a grueling pace. Infantry assaults on strong points would be followed by a surge in casualties. The wounded died on stretchers waiting outside the crowded CCSs. Wounds were gruesome; however, for the medical personnel the greatest burden may have been the hoards of gassed cyanotic men who died a choking death from pulmonary edema. Although outside the range of German artillery, the CCSs were subject to aerial bombardment. Sara MacDonald, the nurse in Brewer's team, required unilateral enucleation after a bombing raid.⁷ During endless hours, surgery teams moved from one casualty to the next and had little time to learn their patients' names.

Lt Revere Osler was a 21-year-old artillery officer in the British Army who was killed during the third battle for Ypres. The circumstances of his death illustrate several details regarding the management of the wounded on the Western Front. Lt Osler's father was Sir William Osler, Regis Professor of Medicine at Oxford University, Oxford, England, and the most renowned physician of the English-speaking world. Lt Osler's mother, Grace Revere Osler, was a descendent of the American Revolutionary War patriot Paul Revere. Lt Osler was born

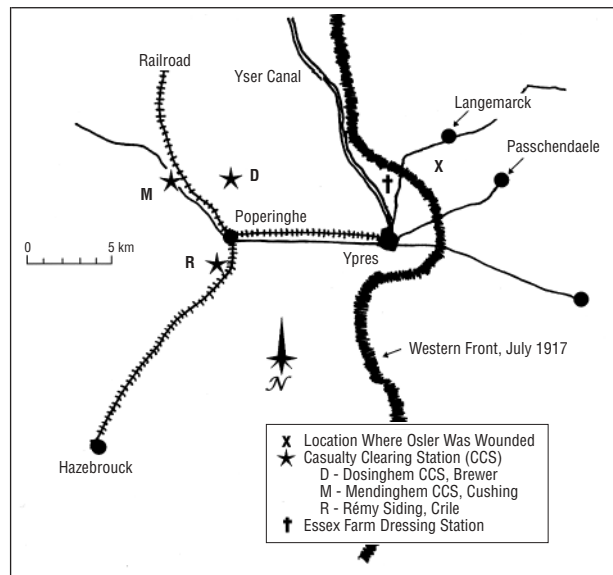


Figure 2. Map of the Ypres salient, showing the location of the key events in the last day of Revere Osler's life.



Figure 3. A photograph taken at Casualty Clearing Station No. 46 in November 1917 after an arduous 4 months with the British Expeditionary Forces during the Third Battle of Ypres. Seated on the left is Harvey Cushing, the leader of one of the surgical teams. Standing behind him to his right is Gilbert Horrax, the leader of the other surgical team who was from Brigham Hospital, Boston, Mass. John Fulton, Cushing's biographer, wrote that it was Horrax "whom Cushing regarded as the most steady and reliable of all the men he had trained."^{9(p634)} Reprinted from Cushing.⁹ Copyright 1936, Little, Brown & Co.

in Baltimore while his father was the Professor of Medicine at Johns Hopkins University.¹⁰ From 1901 to 1904, Cushing lived next to the Osler family and had frequently enjoyed their hospitality.⁶

On the afternoon of August 30, 1917, Lt Osler's Battery A of the 59th Brigade were advancing their guns to a position that improved their capacity to fire in support of infantry.¹⁰ At 16:30, a German artillery barrage caught them in the open (Figure 2). Survivors pulled the wounded Osler to cover. Stretcher bearers carried him to the rear over 3000 yd of slippery mud to a dressing station called Essex Farm located north of Ypres on Yser Canal. Dressing stations were typically a small bunker dug into the ground for concealment and protection. The battalion surgeon at Essex Farm determined that Osler was seriously wounded, ordered morphine, and di-

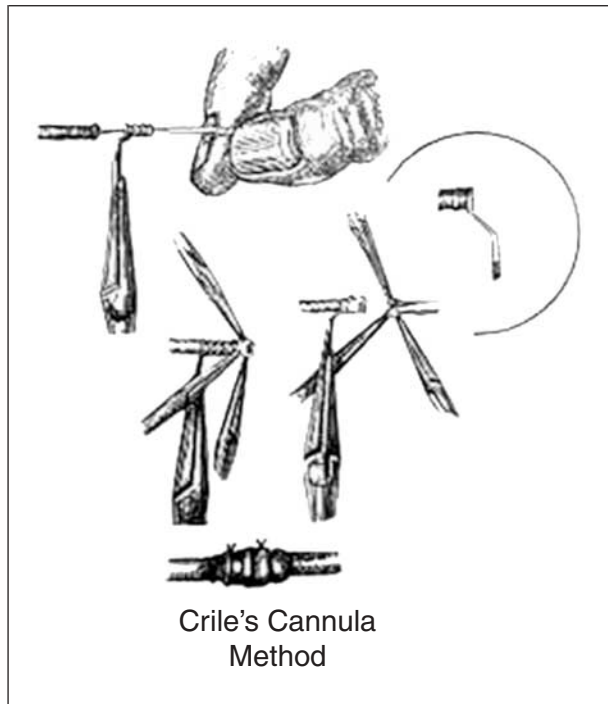


Figure 4. George W. Crile's cannula method for performing a blood transfusion. The recipient's vein is pulled through the cannula, longitudinally bisected, folded back, and secured with a ligature. The donor's artery is pulled over the cannula and ligated. Reprinted with permission from the Dittrick Medical History Center Web site, Case Western Reserve University, Cleveland, Ohio.



Figure 5. A November 1918 meeting of the Medical Research Committee at 12 Place Vendôme, Paris; France. On the left is Harvey Cushing, who had been seriously ill with a mysterious polyneuritis syndrome since October. George W. Crile is on the right. Between them is Col Cuthbert Wallace of the British Medical Corps, who was an expert in gas gangrene. Reprinted from Cushing.⁹ Copyright 1936, Little Brown & Co.

rected Osler be evacuated to a CCS near Poperinghe. A narrow-gauge ammunition train that was returning empty from Ypres to a munitions depot near Poperinghe transported Osler's stretcher. Within 4 hours of being injured, he arrived at CCS No. 47, Dosinghem, which that evening was "taking-in" casualties. He is said to have expressed the pathetic wish of many wounded on the Western Front: "Surely this will take me home".⁹ William Darrach led the surgical team to which Osler was assigned.

Darrach, when he became aware of the young man's notable father, asked George Brewer for assistance. Brewer sent word to his friends Cushing and Crile and asked them to consult. They quickly traveled to CCS No. 47 through the rain and darkness. Cushing described the wounds: "It could not have been much worse, though there was a bare chance—one [shrapnel wound] traversing through the upper abdomen, another penetrating the chest just above the heart, two others in the thigh, fortunately without a fracture."^{9(p197)} To treat Osler's shock, Crile performed a blood transfusion by connecting a donor's radial artery through a metal transfusion cannula to one of Osler's veins³ (**Figure 4**). Crile did not determine if the donor's and Osler's blood were compatible because in 1917 typing and cross-matching had not yet become a standard practice. At midnight, a nurse anesthetist induced Osler with ether. In the words of Crile, "with the splendid Darrach in charge, a laparotomy was performed."^{3 (p308)} Cushing reassured and comforted this young man whom he had known as a child. Cushing was encouraged as Osler's pulse got stronger in response to the blood transfusion. Darrach, with Brewer's assistance, closed perforations in the colon and ligated bleeding vessels in the mesentery. Chest and leg wounds were bandaged. Osler awoke from his anesthetic but remained in shock, and by sunrise he was dead. Lt Osler is buried in Plot 4, Row F, Dosinghem cemetery in Flanders.⁹ In their extraordinary efforts to save young Osler, Crile, Cushing, and Brewer had functioned like university professors and not military surgeons. However, they could assure the boy's parents that everything possible had been done. Sir William Osler remained until his death in 1919 disheartened by grief but always was genuinely appreciative that every effort had been made to save his son.

In early 1918, Crile, Cushing, and Brewer were reassigned to medical units in the AEF. In the final months of the war, Cushing and Brewer were appointed as senior medical consultants and instructed younger surgeons on the care of wounded. Crile focused much of his energy on research during the last year of the war (**Figure 5**). In 1918, Cushing published an article in the *British Journal of Surgery* in which he described his techniques for surgical treatment of intracranial injury. It remained until the next war the definitive article on the topic. The work is all the more impressive an accomplishment considering the austere and distracting circumstances under which Cushing wrote it.¹¹

Crile, Cushing, and Brewer were honorably discharged from active duty in 1919. They returned to their families, took up their academic positions, and resumed their professional careers. In their war service they chose to be leaders because they were convinced that American surgeons needed to prepare to treat the new type of casualties. Furthermore, they helped develop effective surgical treatments for some of the devastating wounds modern war produced. They had demonstrated that surgical teams composed of personnel who routinely work together can be quickly moved as a unit and operate effectively in a new environment. This tactic has merit in our time, when terrorists with biological and chemical weapons could contaminate hospitals and compel quarantine. Just as Crile, Cushing, and Brewer delivered excellent surgical care in the austere environment of Flanders,

surgeons in the 21st century should recognize that adaptability and basic surgical skills are what will enable them to effectively treat patients in a mass casualty crisis. Crile, Cushing, and Brewer were patriots. The day before Christmas 1914, Cushing, in response to Crile's question would he form a unit to work at the American Ambulance, wrote, "I should of course be glad to go . . . with an idea of service."^{3(p250)} In the 21st century, terrorists have threatened America's civilian populations, and we find we are engaged in a new kind of war. American surgeons are once again called to continue a tradition of national service in a time of crisis.

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