Historical Vignette

Neurosurgeon as innovator: William V. Cone (1897–1959)

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Neurosurgeons are well known for being productive researchers and innovators. Few, however, have possessed the prolific ingenuity of William Cone. In 1934, he and Wilder Penfield were cofounders of the Montreal Neurological Institute where, until 1959, he filled the twin roles of neurosurgeon-in-chief and neuropathologist.

Because he did not find writing easy, many of his technical inventions and refinements remained unpublished. His numerous innovations included the extensive use of twist-drill technique for biopsy, drainage for subdural hematoma and cerebral abscess, and ventriculography. In the mid-1940s, he developed power tools driven by nitrogen that led to the modern, universally used air-driven tool systems. He had a special interest in the treatment of spinal dysfunction, for which he invented the Cone-Barton skull-traction tongs along with the Cone spinal operating table. He also devised operative procedures for vertebral fracture-dislocation and craniopinal anomalies. For the maintenance of muscle tone in the paralyzed bladder, he constructed a tidal drainage system. He introduced and popularized ventriculoperitoneal shunting techniques and carried out some of the earliest experimental trials to treat brain infections with sulphonamide and antibiotic drugs. He designed his own set of surgical suction devices, bone rongeurs, and a personal suction "air-conditioning" system for each surgeon. He had a keen early interest in intracranial tumors, and also demonstrated on monkeys how subdural mass lesions caused papillary dilation and mesial temporal lobe damage due to cerebral compression. His work for the military during World War II on effects of altitude on brain pressure remained classified for many years. The first clipping and excision of an intracranial aneurysm is attributed to Cone.

Although Penfield was known as "the Chief," Cone was referred to as "the Boss." His fervent dedication to provide total care to his patients was expressed in round-the-clock vigils; he did not separate "nursing" from "surgical" care. Ultimately, Cone's driving passion for perfection led in part to his tragic death. His accomplishments, inventions, and his example as teacher and physician have become part of neurosurgery's collective legacy.

KEY WORDS • William Cone • neurosurgical history • instrumentation • neurosurgical technique • Wilder Penfield

Neurosurgeons are well known for being productive researchers and innovators; however, few have possessed the prolific ingenuity of William Cone. He shared Wilder Penfield's dream as cofounder of the Montreal Neurological Institute (MNI) where he was neurosurgeon-in-chief and neuropathologist. From their early days in New York, they had become fast friends and congenial partners. Cone was well recognized as a superb surgeon. Entin quotes Sir Geoffrey Jefferson who wrote, "I suppose Bill Cone was amongst the best surgeons in the world... several people have said to me that he was the best surgeon they had ever seen." However, because writing did not come easily for him, many of his numerous technical introductions and refinements remained unpublished. In spite of this, his innovations have had a substantial impact upon neurosurgery, often as a result of publications by his students (or others without knowledge of Cone's previous work) so they might not be recognized as techniques developed originally by Cone.

Cone did not keep a diary, nor did he save letters or
write memoirs. Therefore, to learn about him requires reading the notes of others and talking with those who knew him personally. Although several short “reminiscences” and obituarial pieces have been written about him, there is no definitive article detailing his contributions or his career. The purposes of this paper are to provide a glimpse of this complex man, to document his achievements, and to gauge his impact upon neurosurgery. In many instances, the events surrounding Cone’s life remain enigmatic; thus, all anecdotal material in this paper is referenced or was witnessed in person by at least one of us (J.S., G.B., W.F.).

The Early Years
Grandfather’s Influence
William Cone’s Scottish ancestors came to Connecticut in 1646. The descendants moved westward, eventually becoming some of the earliest settlers in eastern Iowa, and founded a community that was later named Conesville.11 He was born on May 7, 1897, and after the death of his father at 24 years of age, Cone (then 4 years old) and his younger brother were raised by their grandparents. His grandfather, William Davison Cone, was a respected general physician in Conesville for over 30 years. Cone frequently accompanied his grandfather, “the Good Doctor,” riding in his horse and buggy or sleigh along country roads.11 It was inevitable that both Cone brothers became physicians. His brother, Alfred, became an otolaryngologist at Washington University and the Barnes Hospital in St. Louis, Missouri. Cone’s later obvious selfless dedication to the care of his patients sprang from his admiration for the zeal he had observed in his grandfather.

Early Work in New York: Meeting Penfield
Cone attended the undergraduate and medical schools of the University of Iowa (Fig. 1). He was musically inclined, but because of his good physical condition and short, bullish stature, he supported himself through the University of Iowa Medical School as a sometime boxer and wrestler. His love of song continued in later years at the MNI where, if work was finished early, Cone and the residents had late-night “sing-alongs” in the residents’ lounge. Upon graduation from medical school in 1922, he was awarded a National Research Council Fellowship to continue his studies in brain pathology on the wards of the psychiatric clinic of Samuel Orton at the University of Iowa (Fig. 2).14,15,19,22 A publication from Orton’s laboratory lists “Vernon Cone” as one of the authors.22 It may be that Cone preferred the use of his second name until this time; however, during the period in New York and thereafter he was known as William, Bill, or Willy.

In 1924, he moved to New York to train in neurology under Frederick Tilney.28 Tilney, professor of neurology at Columbia University, was busy setting up a private practice and planning for the new New York Neurological Institute. However, the old institute building had no laboratory and Cone did not wish to pursue neurology in private practice. Thus, in the same year, Cone gravitated to the laboratory of neuropathology and the growing department of surgery under Allen Whipple at the Presbyterian Hospital in New York (Fig. 3). Like Wilder Penfield, Cone received first-rate training in surgery from Whipple, who also allowed Cone to pursue his interests in neurocytology and neurosurgery. Cone, technically gifted, excelled at all surgical procedures. Besides neurosurgery, he especially enjoyed operations involving the ear, nose, and throat. In later years, Cone occasionally performed procedures beyond the realm of neurological surgery on his neurological patients.

Cone was introduced to Wilder Penfield in 1925, after Penfield returned to Whipple’s department from studies with Ramón y Cajal and del Río-Hortega in Spain. He became Penfield’s assistant in the clinic and the laboratory. Together they established the laboratory of neurocytology. Cone became junior attending surgeon and took his training in neurosurgery under Penfield at the Presbyterian Hospital.29 From their early discussions over the microscope grew a deep affection, respect, and companionship that continued over the next 36 years. In Cone, Penfield observed a man of spectacular talent, great drive, and unbounded enthusiasm; he saw Cone as a fulfillment of destiny, good
luck, and kindly providence. Together, they were responsible for the neurosurgery service at the Presbyterian Hospital under Whipple. Penfield wrote of Cone, "He learned fast. Soon, he seemed to double my potential. He became my alter ego throughout the hospital. He acquired the art of neurosurgery and patient care as if by instinct. He learned from Whipple... general surgery... leaping over the intern and residency in sequence, reading widely, and approaching his specialty with the basic understanding of pathology and anatomy that he had already mastered."

Cone's fervent dedication to his work became evident during 1926 and 1927. While Penfield would break off for a few days to collect his thoughts, finish manuscripts, and regain his drive, Cone did not tire. He rarely turned aside for diversion. He accomplished much of his work on neuroglia during this period. Penfield's projects became Cone's projects although, to his surprise, he discovered that Bill Cone found writing difficult. "Cone was a doer and a reader, not a creative writer." Evening hours found him in the hospital, "carrying out some kindly act for a patient with the help of the intern, or working in the laboratory." In 1928, Penfield accepted a position to combine the neurological and neurological services at the Royal Victoria Hospital in Montreal. He invited Cone to accompany him. Penfield, uneasy at moving to Montreal alone and inevitably thinking that Cone would stay in New York, searched in vain for others who could meet his qualifications. Meanwhile, Cone received invitations to stay in New York as part of the Presbyterian Hospital and the burgeoning New York Neurological Institute. He was offered his own neuropathology laboratory. Charles Elsberg and Allen Whipple "made a terrible drive to keep Cone," promising "all the neurosurgery you can do." Percival Bailey also wanted Cone to join him in Chicago, but despite these attractive offers Cone decided to move with Penfield to Montreal. Fellow neurosurgeon Byron Stookey described Cone's potential position in New York to be "the biggest opportunity I ever saw a man turn down." Penfield was not certain why Cone had made his decision to go with him, but felt that "friendship, the challenge of an ideal, or the promise of teamwork" had all contributed. They were in "double harness, as friends with a common enthusiasm." Cone's commitment led to the beginning and fulfillment of Penfield's dreams. Penfield believed that together "they were something more than any individual can be."

**The Move to Montreal**

Before arriving in Montreal in the autumn of 1928, Cone completed 6 months of postgraduate studies on a Guggenheim Fellowship. In London he studied neurology at the National Hospital for Nervous Diseases at Queen Square, and observed neurosurgery at the London Hospital with Hugh Cairns (who was introducing...
the fastidious surgical technique he had recently learned from Cushing). He also visited in Breslau with Otfrid Foerster, and the surgical unit in Hamburg.

Even after arriving in Montreal, Penfield felt threatened for a second time by offers that Cone received from other institutions, such as the University of Pennsylvania. The University of Iowa also proposed that he could be chief of neurosurgery with a double professorship in neurology and neurosurgery. But after returning to Montreal from a visit to both centers in 1934, Cone reported to Penfield, "I've made up my mind, Wide [Wilder] to stay with you. We've come a long way together. You've been a straight-shooter. I need your help to do what I want to do in life, and you can't get on very well without me here. It's going to be great fun from now on. There will be no place like this [the Montreal Neurological Institute] in all the world...."

With such support and the Rockefeller Foundation endowment to open the MNI, Penfield felt confident to forge on.

At the MNI, Royal Victoria Hospital, and Montreal General Hospital, Cone raised morale, set the standard of excellence, and marked a change in tempo in neurosurgery in Montreal. His personality was especially suited to the work in the early days at Montreal, before staff and nurses were trained and procedures were set. Many patients required constant care, day and night; it was his meticulous perseverance that brought about successful results. He functioned with tireless enthusiasm as neurosurgeon-in-chief and neuropathologist (Fig. 4). He kept an eye on all of the patients, including those of Penfield and the neurologists. Managing the trauma service with a devoted interest in head and spine injuries, his efforts were responsible for the recovery of many severely injured patients, especially those who had to undergo major cranial and spinal surgery. Cone's pioneering efforts in trauma management continued into the 1950's, when he organized with the Royal Canadian Air Force one of the first helicopter services in the world, for the regular transport of the neurologically injured to the Institute (Fig. 5). The helicopter landed in the McGill University stadium, directly behind the MNI. On one Saturday afternoon the university football game was interrupted and the field cleared for a few minutes so that the helicopter could be landed and a patient transported to the MNI, to applause from the grandstands.

Cone was also responsible for the continuity of the hospital...
neurocytological research that he and Penfield had begun in New York. Shortly after their arrival from the Presbyterian Hospital, their collection of brain tissue and tumor specimens, in a large barrel, was mistakenly thrown out by the janitorial service of the Royal Victoria Hospital. After a cursory, but desperate, effort to find them, Penfield gave up. Knowing their value and tracing their ultimate location, Cone and the laboratory technician combed through the immense heap of garbage at the city dump in the dead of a Montreal’s winter night until the irreplaceable sections had been recovered.

A Grueling Schedule

Cone maintained the same onerous schedule at the MNI that he had begun in New York, and exacted the same work patterns from his residents. After dinner with his wife at 7:00 p.m., he would return to the Institute to finish tasks. Frequently, an intern kept watch from the window in the front stairwell for “the Boss” as he sped up University Street in his large black sedan at 7:45 p.m. The word would go out to all residents not on call to quickly leave the hospital. While riding down in the elevator in order to leave the hospital, the residents would crouch below the window of the elevator door so as to escape Cone’s detection. He regularly rounded up the residents for review or preparation of microscopic sections at 10:30 p.m. These sessions sometimes lasted into the early hours when Cone and an exhausted resident would then make rounds. He liked nothing better than to find a case to take to emergency surgery in the middle of the night, on weekends, or holidays. When the operation was completed by 4:00 or 5:00 a.m., the resident and Cone would help the nurses and orderlies clean the operating room and then simply begin the regular surgery list for that day, albeit a bit earlier than usual. Frequently, on Monday mornings, Penfield would return to the MNI invigorated from a relaxing weekend at his country home to find Cone’s residents, who had been working straight through since Saturday noon, gaunt and forlorn.

Cone never asked residents to do anything that he himself would not do, often enthusiastically joining in to help the residents finish their daily routines. He assisted with tube feedings of patients, using his special mixture of corn flakes, eggs, cheese, cocoa, sugar, baby food meats, and vegetables prepared in a blender. One night, on hands and knees in the old second floor tub room of the Institute, he scrubbed the filth from an 8-year-old boy with a head injury.

Even routine maintenance was not below him. Patients, families, and visitors stared in utter amazement one Sunday morning as Cone, in a white shirt and dark suit with orderly in tow, climbed a stepladder to clean ventilators near the ceiling. The family of a patient scheduled to be operated by Cone, after witnessing him climb half-way into the ventilator shaft, refused to believe that he was the chief of neurosurgery and asked for another surgeon until persuaded otherwise. The dawn of one morning found Cone, two residents, and the night nurse, their arms grease to the elbow, happily polishing a rehabilitated operating table that he had salvaged from storage at 4:00 a.m.15

Cone believed that his residents should be involved in the best education possible. He gave freely of his time, teaching them all he knew and withholding nothing. To one resident who was to be married while on his service, he offered a microscope and pathology sections to study while on his honeymoon.

Cone also enjoyed working with the local and referring physicians from Quebec, Ontario, Vermont, and northern New York. He relished and encouraged their visits to the MNI and insisted that they be brought into the operating room, frequently holding up the procedure while they changed into scrub suits. Once they were in attendance, he would begin a detailed discourse of the clinical situation and procedure. After the operation, he also had them accompany him on rounds at all hours. Visits that were anticipated to be brief became all-day affairs; the physicians frequently departed exhausted but appreciative of his involvement and teaching. In 1944, while Cone was performing a lumbar discectomy on a patient under spinal anesthesia, Katherine Hepburn was touring the MNI with a senior resident who had known her family and showed up in the operating room viewer’s gallery. Alerted to her presence, Cone stopped the dissection and welcomed her warmly, introducing in turn his surgical assistant, the anesthetist, the scrub nurse, and even the patient, who, from under the surgical drapes, turned, lifted his head and said a cheery, “Hello.” She was rather taken aback. When Cone insisted that she gown up and come directly into the theater to observe the operation, she replied, “Thank you, but no,” and seemed quite relieved to leave the gallery.

Innovation

A Technically Gifted Surgeon

The surgical decision-making process and the operation itself came as if by second nature to Cone (Fig.
FIG. 6. Cone (left), assisted here by Penfield (right) in 1952, approaching his duty as turkey carver for the annual Christmas dinner at the MNI with the same intensity and surgical prowess he displayed in the operating room.

6), a talent revealed by several of his published articles. His 1936 report detailing myoplastic cranial repair reveals a logical and fastidious surgical technique. His experience with the free bone flap osteoplastic craniotomy, described in 1941, demonstrated the benefits of less cumbersome dissection and avoidance of a bulky tissue mass, of particular advantage in exposure of the temporal lobe and middle fossa. From animal experiments, he was the first to describe the acute physiological changes associated with aseptic cerebral embolism and the mechanism of pupillary dilatation due to ipsilateral uncal herniation. Cone had a special regard for the care of children. In 1930, he was the first to advocate the preservation and reconstruction of the dura in the repair of spina bifida and cranium bifidum to preserve normal production and flow of cerebrospinal fluid. His original interest in neuroglia and glia tumors is apparent in the well-known large series of gliomas analyzed with Elvidge and Penfield in 1935 and with their radiology colleagues in 1945. The first recorded case of successful clipping and excision of an intracerebral aneurysm is attributed to Cone, as reported by his neurological colleague Colin Russel to the American Neurological Association in 1939.

Twist-Drill Technique

Cone possessed astute powers of observation that led to a passion for improving diagnostic and therapeutic techniques. This character trait made itself evident in many of his endeavors beyond his original interest in brain wounds and tumors. In the early 1930's, seeking...
William Cone: Neurosurgical innovator

Improved methods to identify brain tumors or abscesses without resorting to a large craniotomy, he devised the twist-drill method of biopsy, usually performed in the surgical dressing room. He adapted a sharp-edged needle with a round-tipped inner stylus to remove a core of tissue safely, thereby permitting in most instances an adequate pathological specimen (Fig. 7). Biopsy needles currently in use are the descendants of his prototype. Not using stereotactic apparatus, Cone was deft and sure in his biopsy technique, which he also taught to his residents. He even applied this method to biopsy of posterior fossa lesions, such as medulloblastomas with a great success and he went on to apply this rapid technique to the drainage of subdural hematomas and cysts rather than use larger burr holes or a craniotomy.

Air-Driven Surgical Tools

At the start of World War II, Cone along with his colleague, Colin Russel, chief of neurology at the MNI, recruited, equipped, and formed the No. 1 Canadian Neurological Hospital at Basingstoke, England. He served for 2 years as Lieutenant Colonel and director of neurosurgery (Fig. 8). He maintained the same fervent pace even when not taking care of the wounded. In his spare time, he investigated air-driven operating instruments by adapting British and American aircraft engine and hydraulic parts. On his return to Montreal in 1943, he devised four separate types of bone-fashioining instruments powered by dry nitrogen, which was a wasted by-product of liquid oxygen (Fig. 9). The drills (also riveting- and percussion-action instruments) varied in speed from 15,000 to 100,000 rpm, and were introduced in finished form to the operating room in 1949. Several North American and European groups came to Montreal during the next two decades to observe Cone's use of these instruments. Cone had no time to apply for patents and thus his ideas, and in some instances identical tools, were patented and marketed under other trademarks. The current air-drive systems of several major companies are descendants of Cone's original designs.

He developed other instruments as well, including his own set of suction devices, powerful bone rongeurs, and a personal "air-conditioning" system employing a suction apparatus under the face mask for each surgeon (Fig. 10). Fish-hooks with the barbs filed off, attached to a nylon leader and stout elastic bands served as efficient, rapidly placed retractors for scalp, muscle, and cut dural edges. Many minor helpful technical aids to surgery were learned only by working on his service.

Brain and Spinal Cord Injuries

Cone focused a great interest on brain and spinal cord trauma. He was the first to carry out systematic neurological studies on blast injury and to examine the effects of altitude on intracranial pressure through direct observation of the human brain in vivo. Much of this work, completed during World War II for

Fig. 8. Photograph of Lt. Col. William Cone (right) with Lt. Col. Colin Russel (far left) and Wilder Penfield during the latter's 1941 visit to No. 1 Canadian Neurological Hospital. The "No. 1 Neurological" was housed at Hackwood Park (near Basingstoke), Hampshire, England, and by 1945 had become a 750-bed hospital where nearly 17,000 patients received treatment. Always mindful of efficiency and prevention of infection, Cone suggested that soldiers before going into combat should have their hair clipped (as his here), not only to reduce the chances of contamination in head trauma, but also to save time during the "prep" for emergency debridement or craniotomy.
the Canadian military, remained classified for many years.30,47

Cone also devised several types of apparatus and operations for treatment of spinal cord injury during World War II. After bringing the prototype home from England in 1943, he developed the Cone-Barton skull traction tongs with assistance from a general practitioner in northern New York.49 These tongs were far advanced in their increased cervical stability and weight-bearing load. During the war, Cone also built a special operating table for use along with cervical traction tongs to allow improved access, mobility, and safety in treating patients undergoing cervical laminectomies.50,49 This was adapted from Cushing's cerebellar operating table (Fig. 11). The equipment was designed to be light and easily transportable, appropriate for wartime. He also investigated graduated jugular compression as a manometric test for spinal subarachnoid block and as an indicator for timing of surgical decompression of the spinal cord.22

An especially gifted spine surgeon, Cone was far ahead of his time in the treatment of spine injuries. Few residents can remember ever assisting him in a "redo" discectomy.26

In the 1930's, Cone described several operative techniques for the treatment of cervical fracture-dislocation by skeletal traction and fusion.8,49 Cone introduced the "cricket bat procedure" in 1935 for cervical stabilization, developed after a fatal case of atlantoaxial instability that he believed he had not recognized. He was so disturbed by this experience that he would not allow his name to appear on the case report which was published in 1957.48 In fact, he never published a description of the procedure; it was reported some years later by one of his former residents.1

Shunts and Antibiotic Therapy

Cone actively developed ventriculoperitoneal shunting techniques. The first such shunting procedures did not meet with great success. Because the shunt catheters were valveless, the brain often collapsed in the cranial cavity and pulled away from the meninges, causing subdural hematomas. Inspired by Cone's pioneering efforts with shunts, several former residents later produced many of the shunt devices currently in use.

Cone was obsessed with hygiene and the prevention of infection. In the late 1930's and early 1940's, he was
in the forefront of the treatment of brain abscesses with sulphonamide and other antibiotic drugs. He discovered that chloramphenicol could be used to treat meningitis, and convinced the Parke-Davis pharmaceutical company to provide him with chloramphenicol for his purposes. He delivered the purified antibiotic crystals to the patient via lumbar puncture or intraventricular injection. In Cone's own "Chloromycetin factory" in the second floor dictating booth, the junior resident was required to mix the chloramphenicol in glass flasks and then transport it to the operating room. Cone became so convinced of the success of the antibiotic that for a time he required the residents to gargle and swish before they began surgery. Former residents still clearly remember the horrific taste.

Improvements for Nursing and Ward Care of Patients

Cone "did not separate the act of comforting and cleansing from the highly skilled and exacting nature of the neurosurgical procedure." He appreciated the work entailed in the care of neurologically injured or unconscious patients, introducing numerous innovations that improved patient care and lightened the workload of the nurses. He often "tinkered" in his office or workshop, designing and making equipment that he believed would be beneficial for the patient. He introduced the first combined tidal irrigator and cystometer for maintaining the tone of a paralyzed bladder. When his paralyzed patients complained of the Stryker bed frames, he built a removable canvas-strap bed-turning frame operated by one person that allowed for increased patient comfort. To assist bathing, he designed a hoist that lifted the patient out of bed on a frame into the tub, permitting effortless and efficient cleansing instead of the difficult "sponging" in bed. Cone found that frequent bathing and manual massage improved the condition of the skin in paralyzed patients. He promoted an ointment of cod liver oil and bees' honey that became a trademark of proper skin care. It is indeed a tribute to Cone's ingenuity that pressure sores were almost unknown at the MNI. The director and staff of the Montreal Rehabilitation Institute confirmed that patients transferred from the MNI never had pressure sores.

His dedication to the sick generated round-the-clock vigils. Oblivious to conventional life, he ignored his own comfort and convenience. A small, but stocky and powerful man, he could make any patient comfortable by gentle positioning and handling, along with his soothing, rich baritone voice and enormous brown eyes. He carried on because of an astonishing energy reserve, the tacit cooperation of residents and nurses, and an uncanny ability to replenish his strength by snatches of rest. "To be Cone's patient was to feel that you were in the hands of a master and that your total welfare was his over-mastering concern [sic]."

Generosity Toward His Residents and a Competitive Spirit

Although an arduous worker and supervisor, Cone and his generous, gracious, and understanding wife Avis were kind to the residents, often inviting them home for dinner and parties. With no children of their own, the Cones showed benevolent concern for the hard-working residents. To be sure, there were moments of humor with the residents, such as when he dipped himself a heaping spoonful from a lidless jar marked "honey," only to discover, as he pulled it from his mouth completely clean, that it was bacon drippings. Often while on rounds on the 2 South Ward, Cone and the residents would partake of the sherry-based "Vita-
min B-plex” elixir provided to them by the head nurse from the medicine cupboard. To maintain their outward appearance of health, he sent residents up to the “sun room” for a couple of hours under an ultraviolet lamp after he complained that they appeared so pale. Always in the back of his mind, however, was the care of patients; thus, he often left his own parties early (for example, his own 60th birthday party) with the designated residents accompanying him to return to the hospital to finish the night’s labor.

Cone and Penfield maintained a spirit of friendly rivalry. On one occasion Penfield and his resident reported to Cone that they had initiated a craniotomy and removed a large bone flap in 18 minutes. Not to be outdone, the next day Cone asked his scrub nurse to time the opening. During the somewhat frantic but rapid exposure, instruments flew between the resident, Dr. Cone, and the nurse, while the circulating nurse mopped Dr. Cone’s brow almost continuously. At the moment the bone flap was turned, Cone asked the nurse for their time. After minor covert adjustments, she stated, “15 minutes, sir” (being the record to date). After a brief pause, Cone replied with a sigh and a slight chuckle, “And we didn’t even hurry.”

The Search for Perfection and the Melancholic Final Years

Cone’s driven personality made itself more obvious in the late 1940’s and early 1950’s. He could be sulky, petulant, impatient, and often very difficult; as well, he could be extremely manipulative with his occasional long sighs. His earlier incessant search for perfection became an endless battle in later years. He frequently became enthusiastic about a project and worked everyone involved to a “frazzle” to complete it. He gathered the material, discussing and reworking it many times, but never seemed to be satisfied. Losing interest, he would let it drop as quickly as he had taken it up. Residents who wished to finish the work toward presentation at a major meeting were usually met with studied neglect on his part, and the matter dropped. Although he was a member of many scientific and medical societies, he shunned most meetings. In particular, however, he enjoyed the Society of Neurological Surgeons (of which he was President from 1950 to 1951) and he was an active member of the Halsted Club.

Cone no longer tolerated lack of perfection even in his life apart from the Institute. Because he could not match his golf handicap of younger days, he avoided the game. He also had no desire to learn French because he could not attain a perfect accent. He seemed to be possessed of a “divine discontent” that not even his closest friends could dispel.

Cone’s melancholic trend may have begun with the growth of the Institute staff to develop new areas in brain research and treatment. A little-known fact is Cone’s experience with epilepsy surgery; he had frequently assisted Penfield in such cases. With the arrival of Herbert Jasper in 1938, Penfield seized the opportunity to realize his goal of greater investigation into the pathophysiology and surgery of epilepsy, and became less dependent on Cone in this field. Cone may have viewed this as a drifting apart of their intimate friendship and closely intertwined goals.

Cone’s loyalty to the Institute, staff, residents, and nurses was unflinching but, by 1954, a sense of melancholy, gloom, and restlessness had begun to plague him. A sadness came to show itself when his face was at rest. “When in a positive swing, WVC was simply charming. His eyes sparkled. His smile was gleaming and winsome. His bright mischievous expression presaged witty utterances. During the prolonged, frequent depressive spells, he prowled the Institute floors with head and nose down, for all the world looking rather like a moose. It was in this mood that he set the strings of tasks for his house officers, and sought tasks for himself.” (M Rayport, personal communication, 1993). Thus, the residents adopted a system assessing his degree of depression by the attitude of his head and the apparent length of his nose that they called “Moose 1, 2, 3, 4, or 5.” In the late 1950’s, Cone had many “Moose 5” days; he would lock himself in his office for hours at a time. Perhaps he realized that the synchrony he and Penfield had had in the early days was no longer
spite of this and his brilliant retentive mind and his loyalty to the ideas of scientific perfection. I suppose Bill Cone never quite understood the hopes and the thinking at the back of my mind. What the order of priorities was that would determine his way of life was not for me to judge . . . the time would come when he would be surprised that I should put loyalty to our work in the world, and to the achievement of the team that he and I had created together, above the claims of our own personal friendship.”

Years later, in 1968, when Penfield was collecting funds for the Vanier Institute of the Family, he wrote in his diary, “I could use . . . a prima donna in the field of communication and a Bill Cone in the position of conference organizer.” It was a tribute to how vital Cone was in the back-room homework which often spelled success for Penfield’s approaches to garner funds for projects at the MNI.

Cone was consulted less and less about the day-to-day administration and critical decisions of MNI to which he had once been privy. Others were recruited from the outside to take the MNI into the future. Penfield feared “that someday he [Cone] would break under the strain of unremitting struggle.” Indeed, sometime after midnight on May 4, 1959, Cone ended his desperate search for perfection, quieting his restless spirit. He was found at 5 a.m. by the night watchman; his head lying comfortably on a pillow positioned carefully on the floor by his desk, a victim of cyanide by his own hand. The resident with Cone earlier in the evening had no hint of his careful plans. In death he was as perfect as in life: all the day’s labors were successfully completed, all patients were stable, and his office and desk were in pristine order. His life was taken away in the place that had been the scene of his triumphs and ministrations. The loss of Cone was profound. The exact explanation for the loss of such an enormous friendship eluded Penfield for the rest of his life. Penfield commented, “I realize that he took something of me with him. . . . Failure to achieve perfection in his own work and that of the Institute to which he gave his life seemed to him an intolerable tragedy.”

Callousness, harshness, and lack of devotion, however, never overcame Cone, even during the last years. In 1955, during a university honorary degree ceremony for himself in another part of the province of Quebec, he stole away to accompany a seriously injured farmer on a train to the MNI. While still in morning coat and striped pants, he chose a plan of action as he assessed the radiographs. The farmer recovered completely after emergency spinal cord decompression and stabilization.

A Tribute

Was Cone an obsessive self-destructive man tending to manic-depression? Arguably. Was he a perfectionist? To be sure. In whatever way one views William Cone, there can be no doubt that he was one of the most productive and innovative of the early generation of neurosurgeons. Few men have left a legacy of accomplishments that have touched so many lives (Fig. 13): As his surgical colleague, Arthur Elvidge, put it, “His work will shine for many years.” Many of his refinements and technological improvements remained un-

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Fig. 13. A portrait of Cone by Youssef Karsh in the early 1950's. It is not the torturous hours that many former Cone residents remember, but the twinkle and warm glow in his eyes as he reviewed microscopic surgical specimens with them during late hours.
published (in total, he published only 43 papers and none after 1949); nevertheless, his meticulous style of surgery, the ideas he generated and taught, and his consistent care for the patient spread to many other neurosurgical centers by trainees and nurses whom he had influenced. Moreover, his unbounded enthusiasm and devotion to neurosurgery live on in them and in those whom they train in turn. To be one of "Willy's Boys" was not only to have a "boss," but a second father as well.43 Penfield stated "that whatever I may have contributed to neurosurgery or to research, I have Cone to thank for making it possible to concentrate on the problem. He helped me with my patients as if he were my consultant and houseman."28

A former MNI fellow remembered Cone this way:25
... He gave
To each, his utmost. Surgeon, doctor, friend
And nurse to not a few... As in a realm outside the usual ken Beyond fatigue, he seemed to walk apart. Abandoned dedication to the healing art A life of giving to his fellow man."

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