Lights in the great darkness

The 1971 Harvey Cushing oration

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In this address one of the most distinguished and thoughtful living neurosurgeons recalls and pays tribute to select individuals who each in their time and way have lighted a path for neurosurgical progress. If, in fact, the neurosurgical darkness is now less profound than at the beginning of the author's career, the change is due in large part to the unique illumination which his own work has shed upon the physiological approach to neurosurgery.

Editor

This national association of neurosurgeons was first enrolled forty years ago as a band of pupils of Harvey Cushing and under the title of the Harvey Cushing Society. Dr. Louise Eisenhardt, an excellent neuropathologist and a friend of Cushing and all his early pupils, gave the first Cushing Oration in 1965.* In this, the seventh Cushing Oration, your president has chosen to honor a neurosurgeon for the first time in this series.

I shall therefore begin with a backward glance at neurology. That is where neurosurgery and psychiatry began. It is where they will surely find their places in the end—in a transformed and broadly-based neurology. I shall speak sometimes of physicians and surgeons I have known, making it personal but with no thought of giving you a complete review such as that made by Earl Walker recently. He edited A History of Neurological Surgery. The chapters were written by him and his Johns Hopkins neurosurgeons. It is an excellent contribution to our background, beginning, as it does, at the very beginning with prehistoric trepanation and following with descriptions of techniques and a series of biographies.

Seen from the point of view of science, the mind and the brain of man still constitute, I dare say, the greatest and the most important of all unexplored fields of knowledge. Many approaches must be made to this great darkness. Our specialty is only one.

Looking back, one can see the lights come on, one by one. What Cushing and you and I and the other workers and dreamers have begun is important. We have learned to cross the body-to-brain frontier, with safety for the patient, bringing him relief and sometimes cure. The door has opened wide, and yet I suspect that the past is no more than a prelude to understanding.

In old time, men who concerned themselves with the brain considered its functions to be a mysterious action-of-the-

* The subsequent orations were delivered as follows: the second in 1966 by Philip Handler on "Science and Society"; the third in 1967 by William Stewart on "Responsibility of Excellence"; the fourth in 1968 by Buckminster Fuller on "Man's Function in the Universe"; the fifth in 1969 by John Millis on "The Paradox of Medical Practice and Medical Education"; the sixth in 1970 by Edwin Crosby on "The Changing Role of the Institution in Modern Health Care."
whole, something akin to the spirits that were thought to move within the body, carrying messages of speech and action. That was before it was known that electric potentials travel by insulated pathways along the nerves. This was the thinking of Galen seventeen centuries ago. Strange to say, it seems to have lingered on in the minds of some, today. They hesitate to believe that there are semiseparable mechanisms within the centrencephalic system that correspond with all transactions of the mind.

The year 1971 is the first year in the second century after the discovery by Fritsch and Hitzig that electricity could activate brain mechanisms. Imagine the amazement when those two young neurophysiologists applied a gentle electric current to the motor convolution of a dog's brain and the sleeping dog moved a paw on the opposite side of the body as though it were a voluntary movement.

In their German laboratory, they understood then, in 1870, that there was action in circumscribed mechanisms of the brain, willed action or seelische Functionen. It had to do with the mind. The mind could activate a brain mechanism or, as these physiologists expressed it in wonder, the spirit could enter and leave the body in a certain area. Let us not quibble about their terminology. Their experiment opened a wonderful century of adventure and advance. Physiologists, like Sherrington and Pavlov, brought to light the integrative action of the nervous system in which the inborn reflexes and the conditioned reflexes played their automatic roles. Hughlings Jackson in London was emboldened to interpret epileptic fits in terms of physiological mechanisms. And other clinicians, such as Jean-Martin Charcot of Paris, read the meaning of isolated destructive lesions of the brain, and localized speech function, motor function, and sensory conduction.

The second century of neurological advance lies before us in 1971. The opportunity for advance in the knowledge of mechanisms in the brain stem and cerebral hemispheres and the mind seems to wait and beckon to explorers of the future. This is the new frontier. No one is better equipped to carry out these explorations than the neurosurgeon. But he must approach his work with a prepared mind of his own, ready to plan, to observe, to hypothecate, and, some day, to conclude.

In 1886, there was a beginning that was important for neurosurgery. Victor Horsley, a young physiologically-minded surgeon, was appointed to the staff of what was then called The National Hospital for the Paralyzed and Epileptic, Queen Square. He applied the dawning knowledge of structure and localization of function to surgical treatment. He had the help, in doing this, of a brilliant company of neurologists gathered in the Queen Square Hospital—Hughlings Jackson, William Gowers, David Ferrier, to name only the early leaders. Horsley carried out ten operations in that first year and spent his extra time continuing his experiments on epilepsy in the Brown Institution.

He acted as a surgeon also at the University College Hospital of London. It was there, in the laboratory of that institution, that he and Clarke built the first stereotaxic apparatus and described controlled exploration of the monkey brain. It was there the young American, Ernest Sachs, came to work with him. Horsley had also been Professor-Superintendent at the Brown Institution, an endowed hospital for the care and the cure of animals. Remarkable as it may seem today, this establishment was combined with an institute for pathology and physiology, and it is interesting to note, in passing, that in 1896 Horsley surrendered this post to young Charles Sherrington.

Horsley carried out the first operation for spinal cord tumor and worked out the procedure of laminectomy. He localized brain lesions successfully, and operated on brain tumors. But his results were disappointing when the work was reviewed. Antiseptic surgery had been introduced by Joseph Lister only during the preceding decade, and the crudities of this technique in his hands, when he had to cross the meningeal barrier between body and central nervous system, defeated his hope of regularly safe and successful operative procedures. Aseptic surgical refinements were being developed in other clinics, especially in Germany, but Horsley continued to employ the crude methods that seemed to serve the purpose well enough in the physiological laboratory.
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Why did he do this? Why did Horsley fail to hold the leadership of neurosurgery that was at first so clearly his? Was it his fault or was it a failure of hospital teamwork? During the thirty years that followed his appointment, he was given no beds of his own at Queen Square! They were held jealously by the Board of Management for the famous neurologists who succeeded each other in dignified stages of advancing seniority. He had little staff help at any time except from the nurse, the "theatre sister." He had no professional surgical service of his own. He turned to University College Hospital, but the patients continued to go to the famous neurologists at Queen Square. In order to operate there, it was necessary for a neurologist to invite him to do so. As tradition has it, the neurologist might tell him where to make the incision and how to do what had to be done inside. But one of the early neurologists on the staff did express his sympathy for Horsley, writing to him in 1896: "You know I entertain the strongest opinion on the injustice of the arrangement by which you have no beds of your own."

So it was, I surmise, that, as the years passed, Horsley turned his great energy to politics and social crusades. Was this the result of the hospital's refusal to provide him with a surgical service? Or was his tendency to do just this the reason he was not trusted? This is a question to which I can give no final answer. But I have the greatest admiration for Horsley, and I suspect that if he had been treated more generously by the hospital he could have improved his technique and created a Horsley School of Neurosurgery that would have survived him. He did not do so. I have spoken in his defense. But it is, as you see, almost a century too late.

In 1886 when Horsley began his operations, the man who was to develop the technique that neurosurgery required was a dashing young surgeon of 34, newly returned to New York from graduate study in Germany. This was William Halsted. After his appointment to the chair of surgery at Johns Hopkins, he proceeded to elaborate and teach, as Fielding H. Garrison expressed it in his history of medicine, the delicate art of the perfect healing of wounds which was "never and nowhere more beautifully demonstrated than in his clinic."

That all this was true, I was able to see with my own eyes. During my first two years as a medical student, I had the privilege of knowing the man who had early inspired Harvey Cushing in his literary and humanistic efforts—Sir William Osler. He had come then to the closing stage of his career, in Oxford. In the following 2 years, I was taught surgery by William Halsted at Johns Hopkins. There, also, I watched what two of Halsted's skillful resident-surgeons, George Heuer and Walter Dandy, could do in neurosurgery. My internship year that followed (1918-1919) was taken at the Peter Bent Brigham Hospital where I watched Cushing's skilled performance in and out of the operating room.

Neurosurgery attracted me. But at that time it dealt almost exclusively with the radical treatment of brain tumors and intractable pain. Neurophysiology intrigued me even more, as it has continued to do all my life. So I returned to Oxford for a year of graduate study in the Laboratory of Neurophysiology with the great Charles Sherrington. This was followed by a second year of graduate
work at Queen Square, London, where I learned some neuropathology and neurology. For a time, at the National Hospital, I assisted Horsley’s pupil and successor, Percy Sargent. It was easily apparent, then, that leadership in neurosurgery had already moved across the Atlantic to the United States.

Neurology, however, had little therapy of its own anywhere. As I watched it being taught in the outpatient clinics of London by great neurologists—Gordon Holmes, S. A. Kinnier Wilson, Henry Head, George Riddoch—it was largely a diagnostic art. Neurochemists and electrophysiologists had not yet entered the field, and psychiatry was only just emerging from the asylums. The clinical neurologists taught the localization of lesions and followed patients through to autopsy where it was neuroanatomy that fascinated them. J. Godwin Greenfield taught neuropathology for them from the vast reservoir of pathological specimens at Queen Square and so the long series of graduate students who passed through London remember him with warm gratitude, as I do.

One of the finest teachers I have known was Gordon Holmes—excellent neuroanatomist, good pathologist, and keen, critical clinician. His clinical presentations in outpatient conference, to which graduate students flocked, were dramatic, impressive, exact. And beneath the exterior of a martinet there was an Irish heart of gold.

In Paris, at the Salpêtrière and La Pitie hospitals where Pierre Marie and Joseph Babinski reigned, it was the same—the art of diagnosis and the study of pathology and neuroanatomy. In New York at the Bellevue Hospital, Foster Kennedy made his teaching rounds. Here, too, there was the same emphasis on localization; diagnosis, and post-mortem study.

This was a time of waiting in neurology, waiting for more specific therapy and new laboratory methods. The early period in neurology, too, was coming to its close, the period of pathological museums and displays of gross pathology and the use of unselective tissue-staining that showed little true cytology. Neurology was ready for the chemist, endocrinologist, bacteriologist, and electrophysiologist. It was the time and the opportunity for scientific surgeons to develop modern neurosurgery.

In 1913 Harvey Cushing was called from Baltimore to Boston to be chief of surgery at the new Peter Bent Brigham Hospital and professor of surgery at Harvard. Previous to that, he had been resident and then assistant to Halsted and had eventually specialized in neurosurgery at Baltimore. His results were discouraging at first. Howard Naffziger, who came from San Francisco to Baltimore to train under him, used to shake his head in retrospect, and tell of the bitter saying among the pathologists: “Prepare for an autopsy. Cushing is scheduling a major craniotomy.” But Cushing was persistent. He kept on, dogged and optimistic.

During those seventeen years in Baltimore, he was pupil to Osler, the professor of medicine as well as to his surgical chief. He was a “latchkeyer” who came and went at will in the Osler home. Their common interest was in bibliography and the humanities and friendship.

When Cushing left Baltimore, Walter Dandy refused an invitation to go along. He took over a steadily increasing share of the neurosurgery in the Hopkins Hospital. By 1920, both men were justly recognized in the field. Both had applied Halsted’s fastidious silk-suture technique to all their neurosurgical operating. They had become suddenly the most brilliant contributors to the progressive establishment of modern neurosurgery.

It must be recognized, however, that Charles Frazier was already well considered for his laminectomies and operations for trigeminal neuralgia in Philadelphia. That city had long had a high tradition in neurology. Charles Spiller, neurologist and neuropathologist, worked in excellent cooperation with Frazier. Charles Elsberg, too, who was to help valiantly to build up the New York Neurological Institute, was well known for his spinal surgery.

In 1920, Walter Dandy was, in my opinion, just as brilliant in his mastery of surgical technique as Cushing, and even more daring. Cushing standardized the Halsted technique for his own school of neurosurgery, which was already growing apace. He was possessed of a broader and deeper culture than Dandy. The latter was loyal to Halsted but he seemed to be suspicious of other surgeons. When the Society of Neurological Surgeons was established in 1920, Dandy refused...
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membership. He preferred to work and act and think alone, admitting only his neurosurgical resident to his confidence.

But Dandy's description of methods of intracranial localization by air ventriculography and encephalography in 1918 and 1919 was a great step forward, welcomed eagerly by those of us who were younger than he but frowned upon by other more senior surgeons (Cushing among them). Dandy put the final diagnosis of brain tumors into the hands of the neurosurgeon and freed him from the neurological patronage that Horsley had been forced to accept.

Cushing, however, was widely known by now throughout the world and highly respected. He was generally looked upon as the leader of modern neurosurgery. He was the sort of man who would have been brilliant in any time and place, a Leonardo da Vinci who had turned his major attention to the human brain and its surgery. His incidental drawings showed remarkable talent. In matters of operative technique, he was deft and sure. His writing was so good that when he eventually produced the biography of his personal hero, William Osler, the book received the Pulitzer Prize. His scholarship and interest in bibliography resembled that of Osler. He was very different from Osler at heart, however, for he was a professional "prima donna," if one may use that term, a lonely-minded and intolerant perfectionist.

In the summer of 1921, I returned from graduate study abroad, and was lucky enough to be appointed as the full-time neurosurgeon at the Presbyterian Hospital in New York. This hospital, which was then on 70th Street and Madison Avenue, had just formed an alliance with Columbia University. They planned to build and move to a new Medical Center uptown. The chief surgeon, Allen Whipple, was a thoughtful, scholarly surgeon. He was much impressed by the teaching of Halsted in matters of surgical technique. Whipple and Halsted, as you know, like Cushing and Dandy and Horsley, were difficult egotists, not altogether easy to assist. It was technique that interested them for the most part. I was more than content with my own regime, being free to learn from all and yet having time for my own projects.

Chief among these was a microscopic study of wound-healing in the brain. I undertook this on arrival in New York and kept it up on the side. After two and one half years (1924), I astonished Whipple by asking him for six months of sabbatical leave to go to Madrid. On my arrival there, Ramón y Cajal and del Rio-Hortega taught me the so-called Spanish metallic methods for brain cytology. So, at last, I was able to see the interstitial tissue of the brain, the astrocytes, oligodendroglia, and connective tissue in my experimental scars and in the whole process of healing and reaction within the brain.

Cajal's contribution to the understanding of the microscopic anatomy of the brain was phenomenal. His lovely neuron drawings should still be studied and pondered by all clinicians who hope to understand some day the delicate physiology and anatomy of the brain. Those with some concern for neuropathology must still use the methods of silver and gold to understand healing and reaction in the brain.

I returned to New York burning with zeal to redo the cytology of neuropathology. These Spaniards were not neurosurgeons. But their contribution to work in our field was, nevertheless, of historic importance.

Finally, I would like to point to another light I saw come on in neurosurgery. Otfried Foerster was the professor of neurology in Breslau, Germany.* Before the First World

* When I descended on him in 1928, I was his first English-speaking visiting surgeon as I had been the first English-speaking microscopist to visit the Spanish histologists four years before. Percival Bailey, Metz, and Spatz and others had begun to use the methods without working there. In 1928, with my wonderful wife and four children, I was making a permanent move from New York to Montreal. In the transition period, we spent six months in Europe with headquarters in Breslau.
War, Foerster had been in the habit of assisting the professor of surgery whenever he called on the latter to operate on one of his patients. But during the war Foerster took up the scalpel and began to operate for himself without further training.* Then, a few years after the war, Foerster began to operate on veterans who had developed post-traumatic epilepsy from gunshot wounds of the brain. This had been done before, but Foerster did it with a difference.

The craniotomy was carried out under local novacaine analgesia, to which was added a very effective dose of stern Prussian discipline to keep the patient still. Electrical stimulation he employed to localize the functional areas of the cortex and to guide him while carrying out radical excision of the scarred brain. It makes little difference that the reason he operated under local anesthesia in the first place was that he could not trust the anesthetist to maintain the patient safely under general anesthesia for the long hours of his painstaking procedures. The fact was, that Foerster had opened up a new approach to the treatment of epilepsy. He had done 12 cases in which he had carried out clean radical excision. I had done only one and used a general anesthetic. Foerster's material was still in formalin. The operative results were promising. This was my opportunity. In a few days, the Spanish methods had done their work. We could see the process of reaction and repair within the epileptic brain. We could conclude how best to remove a scar and not leave a scar. With his new approach, we could look forward to studies of cortical localization with the aid of the electrode, all the time working in the patient's best interests.

In 1934, six years later, two new neurological institutes were opened, one in Montreal, the other in Breslau. Both were established with help from the Rockefeller Foundation of New York. But the Foerster Institute, as it was called, was built too late. Its director was old and infirm. It came at a time, too, when Adolf Hitler had already paralyzed free creative research in Germany.

* Some of you will remember that, during the Second World War, Clovis Vincent, who had assisted Th. de Martel, did the same thing after de Martel took his own life on the arrival of the German troops in Paris. Vincent became the first professor of neurosurgery in Paris.

Finally, during the war, ironically enough, an American bomb completely destroyed it.

Foerster was a distinguished neurologist with a keen interest in neuroanatomy, an indefatiguable worker and writer in the field of clinical neurology. But the most important contribution this neurologist made to neurosurgery was this: he pointed the way that would lead us to the study of neurophysiology in man and a way as well to more thoughtful radical treatment of epilepsy.

In September, 1931, the first International Congress was held in Berne, Switzerland. Ivan Pavlov delivered a paper on the subject of his new and unexpected interest—neurosis as it appears in dogs. I went to the meeting with my friend, Francis Grant, an excellent young neurosurgeon who had spent, he thought, too many years as assistant to Charles Frazier of Philadelphia.

For Harvey Cushing, the meeting was a great personal triumph. He gave a private dinner. But let me give you the unvarnished report of a young neurosurgeon, written 40 years ago. Here is a quotation from a letter I wrote to my mother from Berne, September 1, 1931.

"Francis Grant and I crossed (by boat) and, after a day in Paris, went to Chamonix where we climbed Mount Brevern to have a splendid view of Mont Blanc. When we arrived here in Berne we found about 600 representatives from 41 countries." My letter then makes an unqualified judgment of my own part in the Congress: "My paper," it stated, "was not important. Cushing and Sherrington were singled out by the Berne authorities for special diplomas." Then the letter continued:

"Cushing gave a private dinner last night. It was for men that have worked with him at the Brigham, but it included Sherrington and [William H.] Welsh who is now 86, I believe, and was the real founder of the Johns Hopkins, also de Martel, the most distinguished neurosurgeon in France. It was a splendid evening. Saying I was the oldest living representative, he placed me at the end of the table opposite him. Cushing is the most unexpected man I know. He either snubs me or he envelopes me, but what a dynamic force he is!"

I remember the occasion well. As I passed through the hotel lobby earlier in the after-
noon, I spied Cushing in the dining room and entered. He was arranging the table and the place-cards. That was like him—to do his homework well whatever the event; like him, too, to call me his pupil when he knew that would please me whether or not it was strictly true. I had never been his resident but I had often been his pupil; all neurosurgeons were, in one way or another, in those days. To my delight, Cushing placed Sher- rington beside me.

At the major gathering of this Congress, Cushing’s address was the outstanding one. He summarized his results in the surgical treatment of 2000 brain tumors. No one had ever made such a report and the mortality rate had fallen steadily. He seemed in perfect health. But his closest friends knew that, like Foerster, he had almost lost the arterial circulation in his own legs due to long hours of standing at the operating table. This will no doubt always be a professional hazard in our specialty until the time comes when neurosurgeons cease to attempt more than their predecessors could do. But that time, I hope, will never come.

In conclusion, we have made our begin-nings in this specialty, you and I and those who went before. But it is little more than that. There is still so much to be done—so much to understand. Technique is not enough. Every neurosurgeon should make of himself a neurophysiologist, if he can. As I look out toward the horizon, I see many lights. They came on one by one in or near the field of neurosurgery. Some continue to burn. Some flicker and grow dim. You and I must work out our lives, each for himself, in the light that he has lit. Friendship with the patients and teamwork with one’s fellows makes it a rich and happy life.

Looking back at the past, one sees it was inevitable that there should be an early pe-riod of neurosurgery. The advances in neurology called for a special surgery in the 19th century. Many tried to respond. Sir Victor Horsley succeeded. He founded a specialty. But surgical technique was still imperfect. Thus, advance in the modern period waited for William Halsted. He formed the first distinguished school of surgery in the United States. Our modern school of neurosurgery was an offshoot from it. Walter Dandy did much to establish the offshoot.

But Harvey Cushing was father to the school. He made it international from the very beginning. Hugh Cairns came to him from London to be trained, and Norman Dott from Edinburgh, Kenneth McKenzie from Toronto. Thus, the school was never locally American. This was, in a sense, a measure of the calibre of Harvey Cushing. The Cushing Society, now become the American Association of Neurosurgeons, continues the Cushing influence. Indeed, by means of tradition and example, this influence has come to be a cult! Looking forward into the second century of neurological advance, I can only hope that those trained in Montreal will do their part, and more than that, with the other workers who will, no doubt, enter the great field of neurology from Rochester or London, Paris or Munich, Zurich or Tokyo. Many lights will be lit in the years that lie ahead.

And now it is time to bring the seventh Cushing Oration to its close. What a man was Harvey Cushing! Since I had come to know Osier before I met him and since Osler was one of my heroes, too, I realized from the beginning of our acquaintance how deep was the imprint the older man had left on this ambitious young surgeon from Cleveland, this keen, handsome, many-sided genius. In his daily routine, Cushing was, at certain times, all Cushing—a driving, de-manding, sometimes unreasonable, but al-ways efficient master. Added to this, how- ever, he had the saving grace of charm and versatility that was surely Oslerian, at least in part. When he threw an arm over a youn-ger man’s shoulder, the gesture was Osler’s, as I knew so well. As humanitarians and intellec-tuals, the two men were never very far apart.

On our way through this world, we should look for the best in others and make it ours. Harvey Cushing did this. His light is stronger and brighter with the passing of the years. And in that light there is something of the mellow brilliance and the warmth of his two masters, Halsted and Osler.

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