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HARVEY (WILLIAMS[1]) CUSHING

April 8, 1869–October 7, 1939

By Dr. ELLIOTT C. CUTLER

HARVARD MEDICAL SCHOOL AND PETER BENT-BRIGHAM HOSPITAL

Honour a physician with the honour due unto him for the uses which ye may have of him: for the Lord hath created him. For of the most High cometh healing, and he shall receive honour of the king. The skill of the physician shall lift up his head: and in the sight of great men he shall be in admiration.—*Book of Ecclesiasticus, Chapter 38, Verses 1–3. Being the First Lesson for St. Luke's Day.*

No other individual in modern medicine has revealed such a variety of accomplishments as Harvey Cushing: master-surgeon, neurologist, physician, critical investigator, medical bibliophile, inspiring teacher, litterateur, artist! His craftsmanship and technical performance in surgery were superb; his precise exploration of the nervous system made him an eminent neurologist; his care of and interest in his patients were an example for the most devoted family physician and brought to him the faith and love of patients above what is accorded most physicians; his curiosity led him to an interest in original sources and a love of books which resulted in his amassing a great medical library and becoming one of the leading medical historians of his day; his scientific medical contributions form an important background in neurophysiology and endo-

[1] The Williams, his maternal ancestor's name, was finally dropped after his settling in Boston in 1912, where his mail often became confused with that of a surgical colleague, Dr. Hayward Warren Cushing. But an even earlier episode had warned him of this difficulty, for in 1895 when he had taken the examination for house-pupil at the Massachusetts General Hospital, he failed to hear the result for a long time after the other candidates had been notified. Investigation revealed that his notice of successful application, which seemed all-important to him at that time, had been forwarded to the same Dr. Hayward Warren Cushing, one of the most promising younger surgeons of Boston. This first incident was probably a major influence in his dropping the use of his middle name in his publications as early as 1900.

crinology; his product in inspired and devoted pupils is exceptional; and his abilities as a writer both medical and otherwise are attested to by his being awarded the Pulitzer Prize in Letters for 1926.

Harvey Cushing was born in Cleveland, Ohio, on April 8, 1869, and died of coronary occlusion in New Haven, Connecticut, on October 7, 1939. He had long been a sufferer from peripheral vascular disease of the lower extremities and from gastric ulcer, disorders which he bore with a superb stoicism and courage. He is survived by his widow (Katherine Stone Crowell) and four children, Mary, Betsy, Henry and Barbara. William, another son, was killed in an accident while a student at Yale University in 1926. His first American ancestor, Mathew, landed at Hingham, Massachusetts, in 1638, and his ancestry contained a long line of doctor people whose roots were in New England. His great-grandfather, David (1768–1814), practiced medicine in Cheshire, Massachusetts; his grandfather, Erastus (1802–1893), was a teacher in the now defunct Berkshire Medical College; and his father, Henry K. Cushing (1827–1910), was the leading practitioner of his time in Cleveland, Ohio. During my years of residence in Cleveland (1924–1932) I often heard stories of both the ability and austerity of the father. His older brother, Edward, educated at Yale College, Harvard Medical School and the Massachusetts General Hospital, became in turn the leader of medicine in the Cleveland of his day. This brother was somewhat different from his forebears, more friendly and gregarious, loved by children, full of fun and, if the stories are correctly told, much like William Osler. And this brother was Harvey Cushing's direct stimulus and mentor. He took his brother Harvey on trips, talked to him about medicine, and filled him with aspirations and ideals. An early death robbed medicine of the full development of this older brother and Harvey Cushing of further influence from this source. This influence is attested to by the great admiration of the younger for the older brother, an admiration which endured throughout his life. Harvey Cushing liked to dwell on his brother's accomplishments and frequently spoke of his brother Ned's influence, when a house pupil at the Massachusetts General Hospital, in liberating the up-to-then starvation diet of the typhoid patient. It was apparent that the younger brother admired greatly the open and friendly nature of the elder brother and sought to emulate his characteristics. This emulation is seen again in his admiraton for Osler and others whose ease of personal contacts was of the same order. It is indeed a remarkable tribute to the breadth of Harvey Cushing's accomplishments and character that though similar traits were not his by nature, he actually did find time in his busy life for pleasantries and friendly contacts. These characteristics greatly endeared him to his young assistants and to his patients, and when in the later years the pressure of active clinical work had lessened, they became more prominent and brought him hosts of youthful student friends.

From school in Cleveland he went to Yale College (A.B., 1891), and then to the Harvard Medical School (A.M. and M.D. *cum laude,* 1895). A study of Cushing's grades as found on his record in the dean's office at the Harvard Medical School is of some interest. The eleven A's and three B's are in sharp contrast to three C's, especially when we find the latter in therapeutics, clinical obstetrics and clinical surgery (C minus). However, one should know that at that time the curriculum provided only a minimum of clinical work and often the better men deserted class exercises and by their own initiative obtained experience at hospitals. We can easily imagine Harvey Cushing rebelling in the course in therapeutics at the very idea of committing to memory the doses and action of drugs which he foresaw he would never use. Indeed this record itself expresses his early intellectual independence. While still a senior at the Harvard Medical School, his brother Ned took him to Baltimore to visit the Johns Hopkins Hospital and Medical School, though it is dubious whether he met at that time either Halsted or Osler.

Following graduation from the Medical School, he was house officer on the South Surgical Service at the Massachusetts General Hospital. There his unusual abilities were in evidence and his hospital records represent the diligence, care, precision and artistic accomplishments which were soon to flourish and bear fruit. From Boston he went to the Johns Hopkins Hospital (1896–1900) to work under the beneficent influence of William S. Halsted. The shift from the Boston surgery of that day, where speed of operating was still considered advisable and even used as a gauge of ability, to the painstaking, slow and gentle methods of Halsted was an everlasting inspiration to the pupil Cushing. He often told the story himself that, coming from Boston where a complete breast procedure was accomplished in twenty-eight minutes, he saw with misgivings a four-and-one-half-hour operation for the same undertaking. How amazed he was that stimulants were unnecessary and how horrified he was when told not to dress the wound for ten days! Recalling the wounds he had previously studied, he remarked to himself: "I may not see the wound, but I will smell it!" When in ten days the wound was dressed and found perfectly healed, his skepticism disappeared. Moreover, here he was first introduced to the experimental method, was taught the value of careful and detailed records whether in the laboratory or on the ward. From Halsted he learned that precise and thorough concentration on a small problem might yield more than great labors in routine work. Here, too,

he learned the value of a meticulous and gentle technique that sought to spare each cell from being damaged, a technique which was to permit him later to create the surgery of the central nervous system. It is doubtful if Halsted had any other pupil who learned so rapidly and thoroughly the art of surgery as he, Halsted, conceived it.

Finally, his training as a general surgeon completed, Dr. Cushing went abroad (1900–1901), and in Berne through Kocher and Hugo Kronecker accomplished his first work in experimental neurology ("Physiologische und anatomische Beobachtungen über einige hiermit verwandte Erscheinungen." *Mitt. Grenzgeb. Med. Chir.,* 9: 773–808, 1902). This neurological field was to become his life work, and it is of interest to examine the stimulus which brought him to it. My notes made after conversations with Dr. Cushing led me to feel that Dr. Halsted suggested to him the field of neurological surgery, but recently Dr. Roy McClure, who worked with Dr. Cushing during the first year that the Hunterian Laboratory was open and who later became Halsted's resident surgeon, and others have made it certain that Harvey Cushing himself proposed the field to Dr. Halsted. Dr. Halsted's first reply was, "Why, Dr. Cushing, we had only two cases of brain tumor last year!" When Dr. Cushing persisted, Dr. Halsted remarked, "All right, the field is yours." And perhaps there were indications of this leaning even earlier, for the title of Dr. Cushing's second paper was "Haematomyelia from Gunshot Wounds of the Spine. A Report of Two Cases, with Recovery Following Symptoms of Hemilesion of the Cord" (*Amer. Jour. Med. Sci.,* 115: 654–683, June, 1898). This article was spoken of by Dr. Thomas, then professor of neurology at the Johns Hopkins Medical School, as the best investigation of superficial sensory supply carried out up to that time. In addition Osler may have influenced him in this selection. Speculation is incited when we know that Dr. Cushing, while a surgical interne at the Massachusetts General Hospital, had written to Dr. W. S. Thayer to ask if there might be an opening for him on Dr. Osler's staff. This letter to Thayer was never answered, and one can only imagine the consequences had this application received an affirmative answer!

During this early trip to Europe, Dr. Cushing also met Sherrington in Liverpool and in Pavia, Italy, picked up a clinical model of Riva-Rocci's blood pressure apparatus with inflatable armlet which he adapted for use in all his subsequent surgical procedures. The charts on which such records were kept represent the first anesthesia charts, though it should be known that Amory Codman and Harvey Cushing had a wager when house pupils at the Massachusetts General Hospital (1895) as to who could anesthetize without subsequent vomiting and kept records for this purpose. Their pioneer efforts to chart a patient's condition properly throughout a surgical procedure are now bound together in the Record Room of the Massachusetts General Hospital as evidence of a beneficent change in which the youngest members of a hospital staff played a rôle. This effort did not originate with these young men, but represented a desire of their visiting surgeon, Dr. Harrington, and was actually in use before Harvey Cushing went on service.

On his return from Europe, Cushing became the neurosurgeon of the Johns Hopkins Hospital group. It was a difficult and discouraging beginning. The mortality was terrific, though better than that obtained by other surgeons. Always there was extreme diligence and thoroughness. Autopsies were secured whenever possible. The reasons for catastrophes were thus explained and technical perfection thus secured. The happier field of the surgical treatment of trifacial neuralgia was reopened, studied and made safe. Laboratory efforts previously in the field of general surgery continued in this newer field, and soon he began to investigate the pituitary body. Tumors of it were studied; investigation of its functions grew apace; and by the time of his removal to Boston, his first book appeared, "The Pituitary Body and Its Disorders. Clinical States Produced by Disorders of the Hypophysis Cerebri. An amplification of the Harvey Lecture for December, 1910" (J. B. Lippincott Company, Philadelphia and London, 1912).

These formative years in Baltimore, when his work hardened entirely along neurophysiological lines, were the years when he discovered in William Osler a chief stimulus and mentor. They were next-door neighbors, and his footsteps were often turned to Osler's home, where he found the encouragement, guidance and leaven which only such a brilliant character could give. Here he began to acquire his love of books and his amazing information in the background of medical history. Here he gathered in acquaintances from many corners of the world to emerge a real cosmopolitan. Osler's departure to Oxford in 1905 seemed a great loss to Harvey Cushing, but by this time he was well started in his bibliophilic adventures and perhaps was really benefited by the independence of thought and action which this separation enforced. Anyway, the trail between these two was now well established and their correspondence formed a major tie of interest for each until Osler died.

In 1910 he was simultaneously appointed professor of surgery at the Harvard Medical School and surgeon-in-chief to the Peter Bent Brigham Hospital. It is clear that the trustees under the will of Peter Bent Brigham, who had died in 1877, had at last decided that the time was ripe to construct the hospital, which the donor had specified was to care for "sick persons in indigent circumstances residing in the County of

Suffolk." The new Harvard Medical School had been opened in 1906, and one can visualize the wise heads that brought together the Harvard authorities and the Brigham Hospital trustees. But it was not until August, 1911, that ground was actually broken, on a cow-pasture adjacent to the new Medical School, and the construction of the hospital was only partly finished when Dr. Cushing with his family moved to Boston in the summer of 1912. At this time his Medical School title was changed to that of Moseley Professor of Surgery, the position in surgery previously filled by Maurice Richardson. Now he began to organize his work in the Harvard Medical School laboratory and in the partly constructed hospital, which was to open its doors in January, 1913. The appointments of David Cheever and John Homans to the senior staff gave to the new hospital the most promising of the junior surgeons of Boston of that time, and his house staff, largely composed of Johns Hopkins men, contained a few Harvard graduates of the class of 1913.

Soon the work was in full swing, and the details of his accomplishments at the Brigham Hospital are readily accessible in the Annual Reports of the hospital. It is appropriate to point out here that Harvey Cushing and his colleague Henry Christian, put great emphasis on the value of professional hospital reports. Here they reviewed and prophesied the changing character of both medical education and medical practice and thus elevated hospital reports to a useful professional level. At first he kept his interest in the general surgical clinic, but his prominence in neurosurgery was so outstanding that gradually this field occupied all his energy and time. That his primary interest lay in neurophysiology and neurosurgery is perhaps better reflected in the laboratory efforts of his full-time assistants, which began with the work of Lewis Weed, his first Arthur Tracy Cabot fellow,[2] whose important contributions to the cerebrospinal fluid circulation appeared in 1914. Yet, in spite of these responsibilities, there was at first time for tennis and frequent discussions with the devoted members of his house staff. Indeed it was these informal meetings plus his weekly rounds on patients with other than neurological disorders and the influence of his great example in the care of his own neurological patients which permitted him to be the major influence for many years to come on many pupils whose interest lay in the field of general surgery. And from time to time he did take on the performance of some unusual task in the field of general surgery, and such procedures will long be remembered by the internes of the first few years of the Brigham Hospital as among their greatest moments of inspiration. Before the Great War was upon us, he had become one of the leading surgeons of our day, a matter attested to by the invitation to give the oration in surgery at the International Congress of Medicine in London in 1913, "Realignments in Greater Medicine; Their Effect upon Surgery and the Influence of Surgery upon Them." (*Brit. Med. Jour.* 2: 290–297, August 9, 1913. Also: *Lancet,* 2: 369–375, August 9, 1913.)

Then came war, and for Dr. Cushing two experiences, one with the French Army at the American Ambulance Hospital in Paris, April, 1915,[3] and later, after the United States had entered the war, with Base Hospital No. 5 in France, May 1917–May, 1919. His great abilities soon led to his removal from this Base Hospital group, of which he was the organizer and peace-time director, to become the senior consultant in neurosurgery of the American Expeditionary Force. During these experiences his tremendous labors under the severe physical strain of forward conditions brought comfort and life to many an injured soldier, but his unsparing devotion to the task eventually undermined his health and left him a sufferer from arterial disease for the remainder of his life. All through this period of immense physical strain, his publications continued. His contributions to the care of intracranial war-wounds set the proper methods in this field. Great as was his devotion to professional work, he found time to keep up his daily "Journal," a habit begun in youth and continued throughout his life whenever he traveled away from home. In 1936, excerpts from his daily "War Journal" appeared in book form, "From a Surgeon's Journal" (Boston: Little, Brown and Company, 1936). For his great works in France he was honored by his own country by the award of a "Distinguished Service Medal," by Great Britain by the Order of the "Companion of the Bath" and by France with the position "Officer of the Legion of Honor."

During this war experience there were several trips to England and each time the long-desired visits with Osler. On one of these occasions the writer was present and recalls as brightly as if it were but yesterday the witty and brilliant chaffing which flowed forth at

[2] This fellowship was endowed through the generosity of Dr. and Mrs. F. C. Shattuck in honor of Mrs. Shattuck's brother, who had been a leading surgeon in Boston and a visiting surgeon at the Massachusetts General Hospital when Harvey Cushing was a house-pupil.

[3] At the outbreak of the European War Americans in Paris organized the American Ambulance Hospital under the auspices of the American Hospital, a small incorporated hospital largely used by the American colony there. The French Government placed the new Lycée Pasteur in Neuilly at the disposal of this new Ambulance Hospital. One of the three services was organized to be staffed by groups which rotated every three months from American Medical School Hospitals. A unit under Dr. George Crile from the Lakeside Hospital, Cleveland, Ohio, began this service on January 1, 1915; the Harvard Medical School unit followed, April–June, 1915, and was in turn followed by a unit from the University of Pennsylvania Medical School. Dr. Cushing remained with his unit only for the month of April, 1915, returning via England, where he visited Sir William Osler.

the time. It was shortly before Revere Osler's death, and though the imminence of disaster seemed in the very air, the comfort and happiness of the guests was overwhelming. Conversation this time drifted from the first written medical document, a piece of stone covered with unknown writing, to how difficult it was for the British to learn the value of corn as food for man, having for centuries thought it fit only for pigs and chickens! All the time Harvey Cushing sat wrapped in devoted and appreciative silence.

After the war he became reestablished in Boston, and his labors in neurosurgery took on their final form. His interest in general surgery lagged, for there was no time for it. Assistants flocked to his side to work in neurology and neurosurgery, and the output of their work and influence is world-wide. In the midst of all this William Osler died, and at the request of Lady Osler he took up the writing of a biography. It was a labor of love, but it was accomplished with the same tools and vigor that surrounded all Harvey Cushing's works. First every possible source of information was gathered in and digested, the smallest references in daily newspapers were consulted and from this background the great two-volume biography appeared. Small wonder to those who knew of the sincere efforts that the product would be so universally acclaimed.

On the occasion of his sixtieth birthday, 1929, his pupils dedicated to him a collection of their writings. This "Festschrift" special number in honor of Harvey Cushing's 60th birthday; (*Arch. Surg.*, 18: 935–2045, 1929) emphasized his qualities as a teacher. The eighty-two papers were contributed by men then holding some of the most important medical and surgical positions not only in the United States of America but in Europe. And the contributions not only were in the field of neurology and neurological surgery but ranged over the entire field of medicine and included historical essays as well as experimental and clinical observations. The impact of Cushing's character and abilities is nowhere better pictured than in this affectionate tribute.

His effect upon the Harvard Medical School Faculty was considerable, even though he and the dean of the school during this period did not always agree in matters of policy and action. Cushing was greatly interested in the establishment of a common library, in the modification of the curriculum with its resultant reduction in didactic hours and was a leader in opposing the adoption of the "full time clinical teaching" in the strict Rockefellerian sense and in opposing a plan that the Medical School edit a text-book which purposed to infiltrate all departments of the school with preventive medicine.

The hospital regulation set by himself and Henry Christian automatically retires the professional members of the Brigham Hospital staff at 63, and this by custom is accompanied by resignation from the Medical School appointment. And so in 1932 arrived the date of retirement set by himself. It came at a time when Dr. Cushing was working as never before, though bothered with peripheral vascular disease and the signs and symptoms of gastric ulcer. The transition from his tremendously active life was great, but he made it abruptly, and surgery was given up. He refused the repeated requests of the Brigham Hospital trustees to remain in service as surgeon-in-chief, and attempts were soon made to entice him to many places, though it was hoped he would stay in Boston and work on his collection of brain tumors. He remained at the hospital for another year, however, and worked in uncomfortable quarters, for he insisted that his successor occupy immediately the quarters set aside for the surgeon-in-chief. The following year he went to Yale as the Sterling Professor of Neurology (1933–1937). Here he was offered an active post, not simply an honorary sinecure, and to a man in the full vigor of his years this opportunity and his natural devotion to his alma mater, which had the vision to utilize his great abilities, turned his footsteps away from Boston and Harvard. With him went his collection of brain tumor specimens and photostatic copies of the patients' records. At Yale he continued a thorough study of this great mass of material, the assembling of which represented such unusual physical efforts. Major fragments of this material had appeared either in book form, as the monograph on the acoustic neurinomas (1917) and the classification of the gliomata with P. Bailey (1926) or in separate smaller publications, notable among these being his final contribution in the field of pituitary disorders, "basophilism," a clinical syndrome which now bears his name. At Yale, the work continued in spite of frequent physical discomforts. Clinical, experimental and historical papers continued. But chiefly there was the continued study of his own experiences in the field of brain tumors, and always there went on the end-result letters and follow-up examinations.[4] Though the Yale professorship terminated in 1937, the work continued unabated, and he was as active from 1937 up to the time he died as at any time in the last five years. The great volume on the meningiomas did not appear until 1938.

On the occasion of his seventieth birthday, his publications were listed in book form ("A Bibliography of the Writings of Harvey Cushing, prepared on the occasion of his seventieth birthday, April 8, 1939, by

[4] As late as July, 1939, a chromophobe pituitary adenoma patient seen first by Dr. Cushing in February, 1926, turned up at he Brigham Hospital to show the writer a letter from Dr. Cushing inquiring about his condition with the request that the writer examine him and send the information to Dr. Cushing. This done, there was the immediate grateful reply, so characteristic of his correspondence with a pupil.

the Harvey Cushing Society." 1939. Charles C Thomas.)

The major books are:

"The Pituitary Body and its Disorders. Clinical States Produced by Disorders of the Hypophysis Cerebri." An amplification of the Harvey Lecture for December, 1910. Philadelphia and London: J. B. Lippincott Company, 1912.

"Tumors of the Nervus Acusticus and the Syndrome of the Cerebellopontile Angle." Philadelphia and London: W. B. Saunders Company, 1917.

"The Story of U. S. Army Base Hospital No. 5. By a Member of the Unit." Cambridge, Mass.: University Press, 1919.

"The Life of Sir William Osler." Oxford: At the Clarendon Press, 1925.

"A Classification of the Tumors of the Glioma Group on a Histogenetic Basis with a Correlated Study of Prognosis." (With P. Bailey.) Philadelphia, London and Montreal: J. B. Lippincott Company, 1926.

"Studies in Intracranial Physiology and Surgery. The Third Circulation. The Hypophysis. The Gliomas." London: Humphrey Milford, Oxford Press, 1926.

"The Pathological Findings in Four Autopsied Cases of Acromegaly with a Discussion of their Significance." (With L. M. Davidoff.) New York: Rockefeller Institute for Medical Research (Monograph No. 22), 1927.

"Tumors Arising from the Blood-Vessels of the Brain. Angiomatous Malformations and Hemangioblastomas." (With P. Bailey.) Springfield, Ill.: Charles C Thomas, 1928.

"Consecratio Medici and Other Papers." Boston: Little, Brown and Company, 1928.

"Intracranial Tumours. Notes Upon a Series of Two Thousand Verified Cases with Surgical-Mortality Percentages Pertaining Thereto." Springfield, Ill.: Charles C Thomas, 1932.

"Papers Relating to the Pituitary Body, Hypothalamus and Parasympathetic Nervous System." Springfield, Ill.: Charles C Thomas, 1932.

"From a Surgeon's Journal 1915–1918." Boston: Little, Brown and Company, 1936.

"Meningiomas. Their Classification, Regional Behaviour, Life History, and Surgical End Results." (With L. Eisenhardt.) Springfield, Ill.: Charles C Thomas, 1938.

The addresses, papers in journals and reports number three hundred and five and, though largely in the field of neurosurgery, neurophysiology and endocrinology, include a large leaven of historical items of great importance.

Honors came to him in profusion. He held twenty-three honorary degrees, and honorary fellowships, membership or corresponding membership in most of the medical societies of the world. He was a past president of the American College of Surgeons, 1922, the American Neurological Association, 1923, and the American Surgical Association, 1927. These honors seemed to please Harvey Cushing, and particularly one of the last he was to receive. He crossed the Atlantic as late as 1938 to receive the degree, doctor of science, "honoris causa," from Oxford.

Death came through coronary disease; first a severe attack that necessitated hospital care and three days later final rest. It came after seventy years of fruitful, vigorous labors for the good of others. The end was perhaps foretold in his long-standing suffering with peripheral vascular disease, which for twenty years gave him great discomfort, though this was known only to his intimates.

It is difficult to analyze and estimate Dr. Cushing's accomplishments, for he reminds us of the great characters of the Renaissance, such as Leonardo da Vinci, who achieved success in many fields. However, Dr. Cushing's accomplishments seem to flow from a single characteristic. This was his *extraordinary capacity for sustained work*. By nature he was essentially *a perfectionist* and *an aristocrat*. Everything was good or bad; there was scant room for mediocrity or in-betweens. His naturally artistic temperament made his technical surgery a work of art, and his abiding desire for accuracy and perfection brooked no compacts with mediocrity. Behind this craving for accomplishing everything that came to hand in a complete and artistic fashion, lay his enormous energy. It was as if he he had a dynamo within him which was unaffected by use. This is visualized better in his unseen activities, the writing of his journal each night, the hours spent in reading pupils' manuscripts, the immense breadth of his bibliophilic forays, only meagerly reported, rather than in his physical labor at the operating table or the publications for which he is so widely known.

A further natural characteristic was his *insatiable curiosity*. He was not content to see something; he must know all about it. This was revealed as well with books as with patients. Thus when he acquired a new book, he was not content just to read the book and show it to others; he had to know all about the man who wrote it, all about the previous owner, about the press it came from and the other works of the printer. Thus an incidental purchase evoked a tremendous labor. And it went on daily.

It would be presumptuous for a pupil to attempt to assay fully the character and qualities of his master, and praise would be an impertinence. We who have benefited so greatly from his teachings and his example can only be happy that the privilege was ours to be near him. I am one of those who will always feel that here was a man who lived completely for the medicine of his day. Everything he touched he made better. His opening up of the field of neurosurgery was but a small part of the man, for this accomplishment, just as his amassing a great library, his knowledge of medical history, his exquisite ability as a writer and

his splendid laboratory contributions all flowed from the basic desire to do the best he could for suffering humanity. Of no other has it ever been more correctly said that he "lived this life up to the hilt."

And what will the patients say? Miss Ida Cannon has told me of the reaction of a patient with Raynaud's disease at the Massachusetts General Hospital when Harvey Cushing was a house pupil (1895). The patient, a bandage on her foot, had viewed with alarm the abrupt approach of the young man in white with a large pair of scissors which she anticipated meant amputation then and there. She related how the first dressing and all others which followed were accomplished with exquisite gentleness and care. She remained a worshipful patient at this same shrine all her life. How could it be otherwise? Never was there a better doctor in the real sense of the word. Everything that had to do with a patient was vitally important, the position in bed, the pillows, the daily bowel movement, the removal of the sutures all assumed equal importance with the surgical operation itself. Here was what sickness needed—complete understanding, great patience and exquisite gentleness.

As I try to look back over a quarter of a century and view not only the immense works but also his effects as a teacher, the latter seems very simple. Harvey Cushing taught by example. He never asked any assistant to work as hard as he did. It was the age-old method of apprenticeship. He hated class exercises and disliked lectures. If there was a patient, it was all right and he would let the class draw their own conclusions. His house staff learned chiefly from his example, certainly the internes did. When one had climbed further up the ladder, either in his clinic or in the laboratory, it was different. The master and pupil met there more or less as equals trying to settle matters. It was natural that Dr. Cushing's curiosity, when coupled with a primitive desire for perfection, should sprout problems daily and many a casual conversation with a member of the house staff ended with the beginning of a new series of investigations.

Little wonder that such an ardent and serious person was impatient with incompetence and slovenliness. It has been said that Harvey Cushing was a severe taskmaster. He was when it was necessary. There is no place for half-heartedness and mediocrity when one deals with life. No effort can be too great if it can be of assistance. Those who worked longest with Dr. Cushing came to admire and love him best, for they knew the depth of feeling and vision behind the critical remarks. Moreover, criticisms were always accompanied by the vision of a better way the next time. And it was not all stern and cold. There were many sympathetic and generous moments. His little kindnesses were not only to the old and devoted pupil, they came often to total strangers in his path. A distinguished surgeon of to-day has recently related to me his early contacts wih Dr. Cushing. He as a young surgeon had spent a month watching from the operating room seats or on ward rounds. But practically no contact had been made. Suddenly, one Saturday morning, Harvey Cushing summoned him: "Here, take this seat to the Harvard-Yale football game!" A moment later, as our friend stood abashed by this sudden offer, "Have you rubbers?" "No." "A raincoat?" "No." "Go down and tell my secretary to give you mine." It was that rainy day of 1923 when "Ducky" Pond derived his pseudonym, acquired a fumbled ball and waddled down a marshy field for a touchdown! And this story had its counterpart many times.

There is no doubt in my mind that Dr. Cushing disliked elaborate functions, and was happiest when at work. Moreover, he wanted to become acquainted with all the people about him and therefore rather frowned on big institutions feeling that there the effect of the master would be either lost or so attenuated there would be little productivity. His devotion to the apprentice system (Hippocratic, he called it) of teaching medicine was well recognized in the Harvard Faculty, where he opposed any movement in medical education that in any way robbed the student of opportunities to meet a teacher at the bedside of a patient.

This method of teaching was the only one Harvey Cushing ever concerned himself with. The author was secretary of the Department of Surgery during an early part of this period and recalls the impossibility of interesting Harvey Cushing in any part of the surgical curriculum which had to do with class efforts. On the contrary, he fought hard in his department and on the floor of the Faculty Room for any change that brought the student and the teacher together at the bedside of sick people. Nor is it difficult to understand this attitude of Harvey Cushing's toward education. He had previously experienced the value of study and independent work, and at the Johns Hopkins Hospital and Medical School this personal experience had been intensified by the methods of teaching so brilliantly successful in that school. Halsted had demonstrated to him the experimental method and had allowed him great latitude in acquiring experience in technical surgery. As a result Cushing would trust his own five senses above laboratory methods and the teaching of others. Moreover, his natural scepticism encouraged the accumulation of personal experience as a chief road to education. Thus he insisted on others acquiring their information through a similar system and method.

Other than this emphasis on education through self-experience, Cushing's influence as a teacher was essentially that of teaching through example. He utilized fully the stimulus which comes through per-

sonal contacts and emulation. As a rule, a man of few words, he produced his effect on his pupils by virtue of his example. He lived for and by work, and to those privileged to associate themselves with him he was as stimulating and instructive a master as there could be. This influence, by the very reason of its method, was a restricted one and produced its chief results among his immediate assistants in the Brigham Hospital and in the Laboratory of Surgical Research of the Harvard Medical School. Such an influence could not permeate the entire student body and though his amphitheater clinics were well attended, there were many students who failed to appreciate his historical embellishments and even avoided his exercises except when they covered the nervous system or the ductless glands, in which fields he was so obviously a leader. But within the hospital walls it was different. Here the young assistant saw and recognized at once two great attributes worthy of constant emulation. First, the perfection of his technical methods. Nowhere else could he see such exquisite handling of tissues; in no other clinics did wounds heal so kindly, nor such dangerous procedures go forward with such little difficulty, moribidity and mortality. Secondly, the pupil envisaged the perfect care of the patient; the unsparing efforts to provoke confidence and comfort; the value of thorough records and their proper use. He was taught that no detail which added either to the information about the patient or to the comfort of the patient could be neglected.

Harvey Cushing's life is ended. His great accomplishments are known wherever civilization flourishes and will pass down the ages to benefit the generations to come. He became a chief decoration of every institution he served, brought great merit to them and assisted many young men to assume a way of life certain to bring comfort and happiness to humanity. He himself would like most to be remembered as one who upheld the first tradition of our profession—let nothing be neglected that can benefit a patient! This was his "vade mecum" and made him stand out as a chief physician of his time.

THE PRESENT STATE OF SOLAR ACTIVITY AND ASSOCIATED PHENOMENA

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THE rise in solar activity recently reported in SCIENCE[1] has been accompanied by changes in the electrical state of the earth's atmosphere made evident by numerous displays of aurorae and ionospheric disturbances affecting radio transmission. While many sunspots have been conspicuous during the last few months, a study of the sunspot numbers during the last few years shows that the actual maximum occurred in 1937. The graph of sunspot numbers from the minimum of 1933 to date printed herewith (Fig. 1) shows the present state of solar activity with respect to the maximum so recently passed.

The curve has been drawn through individual monthly values derived by taking the moving averages of three months at a time. Inspection will show that the highest three months average occurred in July, 1937, with a Wolfer index of 137. It will be noted that this high was followed by an abrupt drop to the end of the year, with a recovery in 1938 to a three-months high of 131.6 centering in June of last year. The subsequent rise during the early part of this year yielded an index of 111 centered about May, 1939. The maximum passed in 1937 was the highest since the maximum of 1870, when the corresponding Wolfer solar index stood at 165.

The rapid decline in the sunspot numbers during the early part of October indicates a decreasing activity for the next six months and that the major trend will be definitely downward for the next four or five years. The next minimum may be expected to fall in 1943 or 1944.

In reviewing the activity of the sun in recent years, it is interesting to note that the interval between the last two maxima—that of 1928 and that of 1937—has been but nine years, as compared with the mean interval between maxima usually taken as 11.2 years. This is the shortest interval between maxima for over a century. Had we attempted to predict the present maximum by adding the 11.2—year average interval to the last maximum, we should not have expected the present period of heavy solar activity until 1940.

At a meeting of the American Association held at St. Louis in 1935, I ventured to predict on the basis of sunspot activity at that time that the next maximum would occur at the end of 1937 or the very early part of 1938. On the basis of the sun's performance during the subsequent four years, it would appear that the sun anticipated even this prophecy by possibly six

[1] SCIENCE (Supplement), 90: 2337, 9, October 13, 1939.

[2] John Q. Stewart and H. A. A. Panofsky, *Astrophysical Journal*, 88: 4, 385–407, November, 1938.

[3] Newbern Smith, Theodore R. Gilliland and Samuel S. Kirby, National Bureau of Standards Research Paper RP1159, Vol. 21, December, 1938.