Historical vignette

The intriguing encounters of Pavlov and Cushing

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Ivan Petrovich Pavlov and Harvey William Cushing were two of the most prominent neuroscientists of the early 20th century. Their contributions helped advance the understanding of the brain and its disorders, and propelled neuroscience into a new era of research and treatment. Although separated geographically and culturally, Pavlov and Cushing exchanged letters and followed one another’s careers from afar. They met only a few times, during international scientific gatherings in the US and abroad. These encounters were captured in journal entries, letters, and photographs, and provide a glimpse into the lives of these two great men and the history of neuroscience at the turn of the last century.

KEY WORDS • Ivan Pavlov • Harvey Cushing • William Bovie • neurosurgical history

YOU are now shaking hands with the world’s greatest living physiologist," said Dr. Cushing, as he introduced Ivan Petrovich Pavlov to his patient. His patient, a well-educated business executive from Pittsburgh, was suffering from a left temporal lobe tumor. Pavlov was visiting the US to attend a scientific meeting, an experience that would be highlighted by observing an operation performed by Harvey Cushing to resect this patient’s tumor. Pavlov was eager to witness the use of the electrocautery instrument Cushing had developed with physicist William T. Bovie, Ph.D., an instrument that had revolutionized the management of vascular brain tumors. This encounter would set the foundation for a friendship that spanned the seas and brought together two great pioneers of neuroscience.

Ivan Petrovich Pavlov

Ivan Petrovich Pavlov was born in the small Russian city of Ryazan on September 14, 1849. The son of a priest, he began his education at the church school and then attended the theological seminary. He soon became interested in the progressive thinking of figures such as M. Sechenov, the father of Russian physiology; Pavlov’s interests lured him away from a career in theology and fueled his passion for physiology.

In 1870 Pavlov left the church and enrolled at St. Petersburg University, where he concentrated on the study of physiology. He soon thereafter produced his first treatise with a classmate, a work on the physiological features of pancreatic nerves. This initial work was so acclaimed that the university awarded him a gold medal for his accomplishment in research. He completed his degree of Candidate of Natural Sciences in 1875, and then proceeded to the Military Medical Academy in St. Petersburg to further his training. He completed his education there in 1879, and was again awarded a university gold medal for his accomplishments.

After a competitive examination, Pavlov was awarded a fellowship at the Medical Academy and continued his research in the laboratory of the famous Russian clinician S. P. Botkin. He obtained his medical degree after completing his doctoral thesis on “the centrifugal nerves of the heart” in 1883. In his thesis, Pavlov described the trophic role peripheral nerves play in cardiac and skeletal muscle. He also proposed that neural reflex loops were the underlying mechanism regulating circulatory organs.

This work generated international interest and, as a result, in 1884 Pavlov was awarded a fellowship in Germany working with Karl Ludwig in Leipzig and Rudolph Heidenhain in Breslau. He returned to Russia in 1886 and began his pioneering studies of the digestive system, rapidly advancing the understanding of the physiological mechanisms of the gastrointestinal system. In 1890, he established the Department of Physiology at the Institute of Experimental Medicine in St. Petersburg, which he chaired for more than 45 years.

His institute quickly became a powerhouse of physiological research. During this time, Pavlov replaced “acute vivisection” with the surgical method of the “chronic experiment,” using fistulas to study various digestive organs in vivo under relatively normal conditions. He published many groundbreaking papers and books during this time, and began to describe the dominant role of the nervous system in the regulation of the digestive process: this was the basis for modern understanding of the physiology of the digestive tract.

This work led Pavlov to the study of conditioned reflexes in dogs. He paid particular attention to the phenomenon of “psychic secretion,” the canines’ response to a distant food stimulus. He described this as a conditioned reflex, and encouraged others to begin investigating the complex interactions between organisms and their environment in a similarly objective manner.

At the 14th International Medical Congress held in Ma-
Pavlov and Cushing

drind in 1903. Pavlov presented “The Experimental Psychology and Psychopathology of Animals,” which defined conditioned reflexes as highly developed forms of reaction by animals and humans to their environment. This allowed Pavlov to prove experimentally Sechenov’s theoretical attempts to explain the reflex mechanisms of psychic activity as conditioned responses.2 Pavlov defined the underlying principles of determinism, analysis and synthesis, and structure. He showed that conditioned reflexes originate in the cerebral cortex and act as “the prime distributor and organizer of all activity of the organism.”2 The work done in Pavlov’s laboratories first described the functioning of the cortex of the great hemispheres, and from this a Pavlovian theory on higher nervous system activity emerged.

Pavlov received much acclaim for his work, and was awarded the Nobel Prize in medicine in 1904 for his work on the physiological mechanisms of digestion. In 1907 he was elected Academician of the Russian Academy of Sciences. In 1912 he was given an honorary doctorate at Cambridge University and in the following years, he received honorary memberships in various scientific societies abroad. On the recommendation of the Medical Academy of Paris in 1915, Pavlov was awarded the very prestigious Order of the Legion of Honor.2

Pavlov’s impact on neurophysiology did not end with his death on February 27, 1936. Pavlov had the full support of the Communist Party and Soviet government, and thus established his homeland as a prominent center for the study of physiology. He trained many distinguished scientists who continued to develop his ideas and advance the field of neurophysiology. The contributions of Ivan Petrovich Pavlov continue to shape our understanding of human physiology today.

Toward the end of his career, Pavlov established a relationship with the American neurosurgeon Harvey Cushing. They were both at the forefront of neuroscience at the turn of the last century, and each was a prominent figure in his own country. They closely followed one another’s careers from abroad, and they exchanged letters. They had the opportunity to meet only a few times; these occasions occurred during the international scientific conferences of the early 20th century.

International Physiological Congress of 1929

The 13th International Physiological Congress was held at the Harvard Medical School and Peter Bent Brigham Hospital in Boston, Massachusetts in 1929. As Mosley Professor of Surgery at Harvard and Surgeon-in-Chief at the Brigham, Harvey Cushing was an important member of the planning committee for this event. His Harvard colleague, Walter B. Cannon, Professor of Physiology, was the meeting’s host and chairman. Together, they helped plan one of the largest international gatherings of scientists ever held in the US. Walter W. Boyd, a good friend of Cushing’s, was the congress’s first visitor to the US as follows (bracketed material in this and other quotes has been added for clarification):

Having saved enough of his Nobel Prize to pay for a trip to America, Pavlov, accompanied by one of his sons [who spoke

At the Congress, the prominent guests were housed with faculty members; Pavlov and his son were the guests of Walter B. Cannon. Ivan Pavlov was the most notable personality at the meeting, making an impression immediately. Cushing described Pavlov’s importance at the meeting:

During that visit he made many friends . . . all of whom rejoiced when he came for the International Physiological Congress in 1929. Pavlov, an octogenarian and quite lame from a recent fracture of the hip, was acclaimed as the most notable figure, but proved in fact to be the most eager and untrivial participant of this long drawn out program. This was remarkable since the language barrier prevented all but a few from communicating with him except through his English-speaking son.4

When Pavlov was introduced at the opening ceremony of the Congress, there was thunderous applause lasting for some minutes. Pavlov was obviously taken, because he made a series of low bows, one of which almost sent him tumbling off the platform. The moderator finally pulled him back to safety, to the mild amusement of the audience. Cushing later described Pavlov as “lively as a cricket and although lame, moves with the energy of a boy of fifteen.”4

During the Congress, Cushing arranged for Pavlov to observe an operation (Fig. 1). Cushing recounted this in his writings:

English], made his first visit here not long after the war. Landing in New York, they found their way to the Grand Central Station, purchased tickets to Boston and boarded a train on which Pavlov was promptly and deftly separated, at the point of a revolver, from his pocketbook containing what was left of his prize money. On reaching Boston quite penniless, he remarked that the U.S.A. was apparently a more dangerous place in which to travel than the U.S.S.R.; he at least had never been robbed there before.4

FIG. 1. Photograph showing Ivan Petrovich Pavlov (standing to the immediate right of Cushing, leaning forward with his left hand on his hip) observing Harvey Cushing as he performs a craniotomy for resection of a temporal lobe tumor during the International Physiological Congress of 1929 in Boston. The inscription, by Walter W. Boyd, reads: “Professor Pavlov watches a Neurosurgical Operation while attending the 13th International Physiological Congress.” Reprinted with permission from the Harvey Cushing/John Hay Whitney Historical Medical Library, Yale University, New Haven, Connecticut.

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Harvey Cushing/John Hay Whitney Historical Medical Library, electrosurgical apparatus. Reproduced with permission from the

Ivan Pavlov tested the cutting and coagulation properties of the undersurface of the calf liver, revealing the various markings left as

Peter Bent Brigham Hospital, Boston.” B: Photograph of the electrode in Dr. Cushing’s operating room on April 21, 1929 in

steak autographed by Ivan Petrovich Pavlov with the electrosurgical apparatus in the hospital kitchen. After he tested to his own satisfaction the

delaying apparatus, he tripped the needle worked, so a lobe of calf’s liver was secured from

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He wanted to see an operation and I accordingly put on a case for him yesterday, a young lad with a right sided hemiparesis, unincise fits, a shadow deep in the region possibly of the left uncus, and without aphasia. Pavlov was interested because this boy was right-brained, whereas Pavlov himself comes of a right-brained family. I thought there would be little more than to do a bone flap and subtemporal decompression and possibly a temporal lobe transection which would reveal a lesion too deep to do more than perhaps verify.

After a nurse had ineffectually endeavored to confine his resistant whiskers with a gauze mask, he was given a box to stand on [at the operation]. Under local anesthesia a cystic tumor was brought to view. The cyst was opened with electrocautery and evacuated. As the nodule was bloodlessly excised Pavlov became so excited he nearly fell off the box into the field of surgery. Had he not been seen by an orderly who steadied him, he would have.

After the surgery Pavlov insisted be shown how the electric needle worked, so a lobe of calf’s liver was secured from the hospital kitchen. After he tested to his own satisfaction the difference between cutting and coagulation current, he triumphantly wrote his name ‘Pavlov’ on the smooth surface. I asked him whether he wanted me to eat the meat in the hope of improving my conditional reflexes or whether we could keep it intact, concise, clear presentation in English of what had gone before. Pavlov would then pick up the thread and continue. This

Two hundred members of the Congress had been invited to the Brigham for lunch and Pavlov came from the operating-room at 2 P.M. to join the group. . . . after lunch, Dr. Boyd, an amateur photographer, succeeded in getting Dr. Cushing and Pavlov out on the tennis courts and took several excellent photographs during moments of more animated conversation [via interpreter].

At the meeting, Pavlov delivered an animated lecture in Cannon’s laboratory on the effects of bromides on experimental psychosy.

Cushing later described the presentation:

Before a small and select group in one of Cannon’s side rooms, we had Pavlov serving up his latest ideas of inhibition in relation to neuroses, absolutely hot from the griddle. Vivid, alert, gesticulating, the old man poured out his phrases . . .

never missing fire, directing his attention meanwhile chiefly to Anrep [the Russian-born physiologist then the chairman of this department at Cairo University], who sat calmly alongside smoking innumerable cigarettes. Pavlov would suddenly stop and point menacingly to Anrep who possibly would ask him a question or two to make sure of his ground—indeed even interrupt him. Pavlov would move his watch and chain, which lay strung out on the table in front of him, along about six inches farther, would slump down in his chair, shifting his ischial tuberosities to one side or the other—whether because the chair was hard or because this was one of his reflexes, I am not sure. Anrep would then composedly begin and give a most brilliant, concise, clear presentation in English of what had gone before. Pavlov would then pick up the thread and continue. This went on for an hour and, except for the intrusion of a few belated guests who crowded into the room, you could have heard a pin drop.

. . . could there have been a moving picture camera to take Pavlov in action at least once, it would have been a record worth preservation. I asked Anrep afterwards if he could write it all out and he said not by the remotest possibility—he was acting under the hypnotic influence of the old man.

At the meeting, Cushing promised to send Pavlov one of his electrocautery units. This turned out to be quite a challenge. Due to international trade regulations, lie could not
Pavlov and Cushing

simply send the unit to Leningrad for Pavlov. Cushing sent it via Italy, and it reached Leningrad only some years later. Pavlov’s son wrote the following note to Cushing in December of 1933:

My father asks me to inform you that finally he got the electro-surgical apparatus of your construction. It is in use from February last ... my father’s scientific staff are specially handling with it, but of course it would be a great advantage if [if] you could realize your intention to visit the laboratory personally and demonstrate the mode of your operation on the apparatus ... my father begs me to thank you very much for all your books you have sent him. We send you our best wishes for the New Year and hope that you feel quite well.3

Pavlov gave another presentation at the meeting, recounted by John Fulton:

Once more Pavlov addressed the Congress and for his paper the meeting was thronged to the doors. He spoke briefly on inhibition in the normal activity of the cerebral hemispheres and Anrep translated. The gathering was naturally most enthusiastic and Pavlov in his inimitable way proceeded with fiery gesticulations and seemed a little distressed over the complacency of the translator, who rendered what he had said with no gesticulations whatever. Pavlov ended by remarking that he hoped he might be spared many more years to continue the work which was so near his heart but that when he was no longer here to carry on, he hoped that others might join hands with him in spirit. The wildest applause followed, everyone rising to their feet, and Pavlov, in making his low bows, once more almost fell from the platform. Professor Samojoff, the chairman, growing anxious, pulled him back by the coat-tails, much to the delight of the audience.5

After the Congress Pavlov returned to the Soviet Union with his son. He kept in contact with Cushing, and the two met again 2 years later in Europe.

International Neurological Congress of 1931

The First International Neurological Congress convened in Berne, Switzerland, in the summer of 1931. There, Cushing was reunited with Pavlov. Cushing’s return to Berne was of particular interest to the attendees; he had done research there 30 years before. Cushing’s paper was described as brilliant—it began by describing his experiences in Berne and ended by stating that he was publishing his final report on statistical analysis of brain tumors. The audience, which included some 25 of his own students, was silent for a moment then stood, giving Cushing a standing ovation.5

Although he did not draw the same attention he had in 1929, Pavlov was also a very popular speaker at the meeting. As he stood to present his paper on neuroses in animals, he was greeted with several minutes of cheering. Pavlov was noted to appear much older at this meeting; his predecessor in inhibition in the normal activity of the cerebral hemispheres and Anrep translated. The gathering was naturally most enthusiastic and Pavlov in his inimitable way proceeded with fiery gesticulations and seemed a little distressed over the complacency of the translator, who rendered what he had said with no gesticulations whatever. Pavlov ended by remarking that he hoped he might be spared many more years to continue the work which was so near his heart but that when he was no longer here to carry on, he hoped that others might join hands with him in spirit. The wildest applause followed, everyone rising to their feet, and Pavlov, in making his low bows, once more almost fell from the platform. Professor Samojoff, the chairman, growing anxious, pulled him back by the coat-tails, much to the delight of the audience.5

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Conclusions

These two great men, a neurosurgeon and a neuropsychologist, met only a few times but went to great lengths to maintain their friendship. Pavlov once confessed to his student Gantt, “I had dinner at the Cushings and it was hard to drink the vodka because it was of poor quality, but it was not convenient to refuse. . . .”1

A compulsion to understand the human brain and its workings drew these two men together; one developed a system of experimentation that pioneered neuropsychological theory, and the other transformed neurosurgery. Each was recognized by the world for his accomplishments, and the barriers of language, distance, and ideology did not keep these two from recognizing one another’s importance. An experimental psychologist who advanced our understanding of the human brain, and a driven neurosurgeon who pioneered management of nervous system disorders—two of the “world’s greatest.”

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References


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