

FRANK HENRY PIKE

Frank Henry Pike, retired, of the Department of Physiology, College of Physicians and Surgeons, died November 13, 1953, in his 78th year, after a prolonged period of progressive physical deterioration. He retained his scientific interest and acumen until at least four days before his death at which time he remarked that he saw no reason to suppose there were in the brain "reverberatory circuits" which remain active independent of any afferent stimulation.

Dr. Pike, and he remained "Dr. Pike" to every one of his students, was born in Aurora, Illinois, January 20, 1876. He was the eighth child of William Dana Pike and Maria Wilmoth Pike. Shortly after his birth, the family moved to Brattleboro, Vermont, of which William was a native, for a period of four years, only to return to Plainfield, Illinois and take up a farm where Frank spent his boyhood.

In 1891 he and his older brother Henry left Illinois to homestead in Colorado, near Montrose, for two years, an adventure which Dr. Pike enjoyed recalling all during his life. Following this, they returned to the Middle West, where Dr. Pike alternately taught school and attended first Valparaiso University and later Indiana University, graduating from the latter in 1903. He received his Ph.D. from the University of Chicago in 1907, working with Prof. A. G. Mathews on the physiology of respiration. This contact with Prof. Mathews was one of the major sources of inspiration for his scientific career.

After four years as Instructor in Physiology at the University of Chicago, in 1911 Dr. Pike joined the Department of Physiology of the College of Physicians and Surgeons (Columbia University) in New York, where he spent the remainder of his life. Although officially retired in 1941, he remained active as a Special Lecturer until his death.

It is, indeed, difficult to assess briefly the contributions of Dr. Pike. Starting his professional career as a physicist, he was equally at home in all the sciences and viewed them as one, an attainment which both fascinated and motivated his followers. One might come to the laboratory expecting to hold the tools while Dr. Pike incised a cat's rubro-spinal decussation only to find him so engrossed in formulating a mass-density relation for M-type stars that the cat remained intact for another week or two.

Dr. Pike's chief interest was in discovering how the nervous system worked. Early in his work he rejected "3-neurone arcs", "synaptic resistance", "neural inhibition", "neural centers" that completely control a given reaction, "vicarious assumption of function", "mass action of the cortex", "cerebral equipotentiality", neural "shock" and many similar assumptions presumed to account for neural control of behavior.

His scientific ancestors were Magendie, Gall, Legalois, Bastian, Hughlings-Jackson, Darwin, Steiner, Luciani, and others, each of whom contributed to the conception of neural organization, formulated and given experimental support by Dr. Pike. All of these men doubted that any one part of the nervous system controlled completely any reaction. Significant investigations of functional organization of the nervous system was difficult because, as Wilhelm Wundt remarked, removing a part of the nervous system shows nothing of the function of the part removed; rather it shows only what the remaining parts can do. Dr. Pike solved the difficulty.

His analysis of the afferent control of respiration gave real meaning to Wundt's remark. It also showed with crystal clarity the absurdity of concepts of neural organization which are based on observations based on single lesions to the nervous system. This classic of neuro-physiological research was beautiful in its simplicity. Using three cats, he cut the respiratory branches of the vagi (afferent) in one, the dorsal (afferent) roots to the intercostal muscles in a second, and the afferent branches of the phrenics (from the diaphragm) in another. In each case, the cat stopped breathing for a few seconds and then resumed breathing.

Arguing from single-lesion insight, it would be said that none of these afferent sources are essential to, or have much to do with breathing. Pike then removed a second afferent source in each of these three cats. In all cases, no matter which pair of the three afferent sources were eliminated, the animal died of respiratory failure.

Dr. Pike's experimental analysis of respiration constitutes the only case in which the afferent organization of any physiological system has ever been completely analysed. But equally important with his findings was the fact that he developed a sound technique for investigating functional organization of the nervous system. He called it the "technique of combined lesions". He mapped out a plan of experimental investigation of the nervous system involving many thousands of combined lesions. He completed, himself, only a small part of the program.

Using his technique of two, three, four or more lesions in the same animal, Dr. Pike showed clearly that there is no "voluntary", as opposed to "reflex", motor pathway from the brain. Rather he demonstrated that biologically adequate reactions require that neural impulses be delivered to the final common pathway from two or more efferent (motor) pathways.

From his work on the afferent and efferent systems he developed his principle of Summation of Stimuli which his students call "Pike's Law". It is this: "In the higher vertebrates, any biologically adequate reaction requires summation from two or more sources on the afferent side and summation from two or more motor pathways on the final common pathway".

The "technique of combined lesions" also enabled Dr. Pike to make a penetrating analysis of the mechanism through which functions are recovered following insult to the nervous system. He demonstrated that recovery took place, not through "vicarious assumption of function" as postulated by Flourens in the early 19th century and by Lashley in the early 20th; nor as a recession of "shock", postulated by Goltz in the middle of the 19th century. Rather he showed that the recovery occurred through an increase of the functional capacity of the parts remaining intact which were also involved in the behavior prior to the injury.

On one of his basic findings, Dr. Pike seems to have published nothing. He was greatly impressed with a belief held by Sherrington and others before him that to the effect that the neurone might have a trophic function which was distinct from, and independent of, the function of conducting impulses. Proof was difficult. No way had been found by which the possible independent trophic function could be isolated from probable trophic function associated with conduction. Dr. Pike and Miss Willy Smith (deceased) found a way in the study of rigor mortis. They demonstrated clearly that the neurones control the metabolic activities of muscle fibers in the absence of transmission of neural impulses.

Dr. Pike left a large volume of uncompleted manuscript, parts of which some of his students will attempt to formulate for publication. One extremely important manuscript, dealing with his final major research, is missing in its entirety from his papers.

The missing manuscript which was practically completed, with the exception of drawings, more than a year ago, presented a brilliant chain of evidence on the origin of the vertebrate nervous system. It showed the development of both the ventral nerve cord and, in another line, the development of the nerve cord on the dorsal aspect - the line through which vertebrates

could have evolved.

Dr. Pike frequently presented his manuscripts to fellow-scientists for criticism. If this paper was submitted for criticism to any member of the Academy, the writer would greatly appreciate such information.

The full stature of Frank Henry Pike has yet to be recognized widely. The complexity of his writings contrasted strongly with the beautiful directness and clarity of his scientific reasoning and design of experiments. He sometimes appeared to write for himself alone, to chuckle to himself as he larded his manuscripts with historial, literary, religious and scientific references, (frequently humorous to him) but which only a very few others had the background to appreciate.

Few men have had a knowledge and understanding of the history of physiology of the nervous system comparable to that of Dr. Pike. He agreed with Bernard Hollander that the generally maligned Francis Gall was probably one of the most brilliant scientists ever to concern himself with the nervous system. Dr. Pike had hoped to help release Gall from the limbo of current abuse.

Perhaps, the character, personality and values held by Dr. Pike are best illustrated in the manner in which he guided and taught his students without ever appearing to guide or direct. He merely raised questions in the student's mind until the young-one devised for himself, believing it to be his own, an experiment which, as his old note-books show, Dr. Pike may have designed in detail ten years earlier.

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