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HOMER WILLIAM SMITH

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A Biographical Memoir by

ROBERT F. PITTS

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HOMER WILLIAM SMITH died in his sleep of a cerebral hemorrhage on March 25, 1962, at his home in New York City. For some time he had been occupied with the revision of his textbook, *Principles of Renal Physiology,* a classic of supplementary reading for students of medicine. He was active and productive until the end.

His death brought to a close what has been aptly termed the Smithian Era of renal physiology. For over thirty years he had dominated his chosen field in a way that few if any have dominated other fields. His personal investigations, his broad and inclusive concepts, the methods of study of function which he developed and popularized, the texts which he wrote, and the many investigators and students of medicine whom he trained or influenced established him as the acknowledged master of all things renal. Although not a physician, he has been widely recognized by clinicians for his contributions to an understanding of functional alterations in renal disease as well as by physiologists for his contributions to knowledge of the functional properties of glomeruli, tubules, and the renal vascular bed.

Although such a thumbnail sketch might satisfy those who knew him only through his publications on renal function, it fails to indicate the scope and catholicity of his interests. Even

as a scientist, he was as much a biologist as a renal physiologist, with, at one extreme, a profound occupation with the problems of consciousness of man and of his role in the universe, at the other, a penetrating inquisitiveness concerning the properties and structure of the plasma membrane of cells. He was a voracious reader, not only in the realms of biological and physical sciences, but also in those of philosophy, religion, art, music, and literature. He had a remarkably retentive memory and could converse intelligently with authorities in many fields. But the characteristic which, to me, set him apart from his peers was the rapidity with which he could grasp an involved concept, examine its several facets, marshal a variety of arguments in favor of and against it, and quickly return it to its proponent, simplified and stripped of inconsequential trappings. His was the ultimate of logical reasoning; it was an unforgettable experience to observe his mind at work.

If there is any real purpose to be served by a memorial such as this, it lies in an attempt to analyze the factors which shaped and developed him into the man he was. Sheer sentimentality would have been anathema to him. A group of those who, at some time in their careers, were close to him wished to have him sit for a portrait to be presented to the Library of New York University College of Medicine at the time of his retirement from the Professorship of Physiology. It was to have been hung in the section on Man's Place in Nature which he had been instrumental in establishing. He refused to sit for a portrait. Another thought was to have a dinner in his honor, to be attended by the many who had worked with him. This he vetoed; he would not attend. Only by the subterfuge of honoring one of his students and former associates at the Medical College Alumni Day was the dinner finally engineered with Dr. Smith in attendance. Rather grudgingly he admitted to a friend, who had long known him well, that he had enjoyed it.

To most of us, he never acknowledged the fact that he knew the dinner had really been in his honor.

By those who did not know him, this refusal to permit personal recognition by friends and colleagues might be interpreted as indicating resentment of the fact of retirement. It was not. He had gracefully and graciously accepted many honors throughout his distinguished career. He simply did not want any demonstration as his active professorial career drew to a close. Furthermore, he had no intention of retiring to a state of passive scientific inactivity. Why recognize the mere transition from Professor to Professor Emeritus? He aimed to remain active and productive. Less than two weeks before he died, he wrote to me asking for my considered guess as to the volume of fluid reabsorbed in the various segments of the nephron; this, in connection with the revision of his textbook.

However, his refusal to permit his friends to pay him homage stemmed in part from personality traits of independence and, shall we say, distance. He was self-sufficient; he could handle his own problems—a fact reflected in many ways but perhaps most disturbingly in his later years in complete disregard of the advice of his personal physician. He was not an outwardly warm individual. Most of us kept our distances, a bit in awe of the master. Yet many of us, when faced with some personal problem, ultimately found that he was cognizant of it and had taken steps which made it easier for us to solve it. He never obviously intruded; he would never permit intrusion by others.

His personal life was not notably happy. His first marriage ended in divorce, his second in the tragic death of his wife. In the decade from 1932 to 1942, when I was an instructor and medical student and was most closely associated with him, he was frequently moody. However, flashes of wit and humor leavened his contacts with those who worked for him and with

him. He was always kindly, the perfect gentleman. Later, as he began to receive the recognition which he so richly deserved and when his home life was more pleasant, he became a warmer, mellower, and more outgoing person. The great joy of his life in later years was his son, Hudi (Homer Wilson Smith), born of his second marriage in April 1951. Smith's way of life, his hopes and plans, were centered around the boy. The two were drawn even closer together by the death of Mrs. Smith.

Dr. Smith was an indefatigable worker, seemingly at all times in library or office, reading, writing, or, with slide rule in hand, calculating and plotting data of his most recent experiments. Despite his concentration on his work, he was always available for the discussion of an idea or an experiment. Furthermore, he would quickly sense flaws in experimental design or argument and suggest appropriate changes. He demanded precision in analytical work and insisted on justification of methods by extensive chemical recoveries. He took pride in the work which originated in his laboratory and would countenance nothing but the best in execution and presentation of experiments.

When one of his associates brought a paper for review, it received the most thoroughgoing editorial criticism possible, to the point of complete reorganization and rewriting, if necessary. When the shock of reading what seemed to be a new paper on a different subject had passed, there was no doubt in the writer's mind that his contribution had been vastly improved. Smith was a master of lucid, logical, and exciting scientific prose. By this laborious process of revision, he taught a number of his associates to write lucidly and logically, although none attained the quality which characterized his expression. Writing was important to Smith and he appreciated that the efforts of his junior associates were important to them. A paper was never placed at the bottom of a pile of accumulated work; it received prompt consideration.

Philosophy was important to Smith throughout his scientific career, not an avocation to which he turned in later years. *Kamongo*, published in 1932, was an expression of his views of man's place in nature, a synthesis of the scientific, humanistic, and philosophic traditions which have influenced the development of man as a biological, social, and creative being. He was concerned with consciousness as the awareness of environment and self, coupled with the time-binding quality of persistence in perception. He recognized its minimal existence in the simplest of cellular organisms and its greatest development in man. His early scientific investigations of the comparative physiology of the body fluids led through his study of paleontology to his erudite essays on the evolution of the kidney, contained in his Porter Lectures and expanded into his book *From Fish to Philosopher*. He summarized his views in the statement; "The human kidney manufactures the kind of urine that it does, and it maintains the blood in the composition which that fluid has, because this kidney has a certain functional architecture; and it owes that architecture not to design or foresight or to any plan, but to the fact that the earth is an unstable sphere with a fragile crust, to the geologic revolutions that for six hundred million years have raised and lowered continents and seas, to the predaceous enemies, and heat and cold, and storms and droughts; to the unending succession of vicissitudes that have driven the mutant vertebrates from seas into fresh water, into desiccated swamps, out upon the dry land, from one habitation to another, perpetually in search of the free and independent life, perpetually failing, for one reason or another, to find it." Smith's science and philosophy were never far separated. To quote again: "Mental integrity is a *sine qua non* of the free and independent life. As intermittent rays of light blend into moving images on the cinematographic screen, so the multiform activities within the brain are integrated into images of consciousness, and brought into an unstable focus to

form that fleeting entity which we call personality, or Self. But let the composition of our internal environment suffer change, let our kidneys fail for even a short time to fulfill their task, and our mental integrity, our personality, is destroyed." To continue the theme with another quotation: "Superficially, it might be said that the function of the kidneys is to make urine; but in a more considered view one can say that the kidneys make the stuff of philosophy itself."

Three of Dr. Smith's scientific monographs have exerted a tremendous influence on the development of renal physiology and on investigators in the field. His first, entitled *The Physiology of the Kidney* and published in 1937 by the Oxford University Press, was a masterful summary of the then existing body of knowledge of renal function. It was an extremely readable book and provided an accurate and up-to-date summary of inestimable value for both students and investigators. No comparable summary had been attempted since Cushny published *The Secretion of Urine* in 1917. It is interesting that *The Physiology of the Kidney* was written as one of a series to be combined into a medical textbook of physiology. The only other monograph of the series to be published was Dr. Fulton's *Physiology of the Nervous System.* These two volumes undoubtedly influenced many young men to take up careers of investigation in the fields of renal physiology and neurophysiology. His second and really monumental treatise, entitled *The Kidney: Structure and Function in Health and Disease,* was published by the Oxford University Press in 1951. This book was a far more detailed and exhaustive treatment of renal function than was his first monograph and encompassed both the normal and pathological states. Its increased scope reflected the great advances in knowledge which had been made in the intervening fourteen years, largely based on the methods and concepts which Smith himself had introduced. Because of its

encyclopedic coverage, extensive documentation, and authoritative treatment, it became known in common parlance as "the bible." It was, however, more a reference work and less suited as a general supplementary text for students. To fill the needs of students for more information on kidney function than that contained in the usual textbook of physiology, Smith wrote his *Principles of Renal Physiology,* published in 1956 by the Oxford University Press. This small monograph was an excellent summary, lucidly written. It at once became a classic for the student as well as the investigator who wished a concise, accurate, and readable discussion of current concepts of renal function. Dr. Smith was in the process of revising and updating this book when he died.

Homer William Smith was born in Denver, Colorado, on January 2, 1895, the son of Albert C. and Margaret E. (Jones) Smith. He was the youngest of six children. His grade school and the first two years of his high school education were received in Cripple Creek, Colorado, where he lived till the age of fourteen. The last two years of high school and his collegiate education were obtained in Denver, Colorado, the latter at the University of Denver, from which he received the A.B. degree in 1917. He described his early environment as economically poor but culturally as broad or broader than that of the average middle-class family which migrated west in the 1870s and 1880s. From the beginning he was interested in science and devoted his free time to amateur chemical, electrical, and biological experiments. His juvenile predilections for gadgets and experiments unquestionably were the forerunners of his adult scientific interests.

Shortly after graduation from the University of Denver he joined the armed forces and was assigned to a battalion of engineers. Fortunately he was soon transferred to the Chemical Warfare Station of the American University in Washington,

D.C. A unit under Dr. E. K. Marshall had been given the task of investigating the biological effects of war gases. Marshall was in urgent need of chemists to participate in his project, and by a stroke of good fortune Smith was assigned to him. The first of Smith's scientific publications, which appeared in 1918, was concerned with this work.

This strictly accidental association of Smith and Marshall developed into a lifelong friendship and loose scientific collaboration. Here indeed the element of chance seems to have played a major role in shaping Dr. Smith's career. One wonders what his subsequent course of action would have been had he remained an engineer throughout the war. With cessation of hostilities, Marshall arranged for Smith to undertake graduate study under Dr. William H. Howell of The Johns Hopkins University School of Hygiene and Public Health, from which institution he received his D.Sc. in 1921. The titles of the publications which resulted from his graduate studies are interesting in that they reflect his early interest in chemistry, an interest which he maintained throughout his subsequent scientific career.

For a period of two years after receiving his degree, Smith worked in the research laboratories of Eli Lilly and Company (1921-1923), then became a Fellow of the National Research Council at Harvard University in the laboratory of Dr. Walter B. Cannon (1923-1925). During this period he was offered and accepted the chairmanship of the Department of Physiology of the University of Virginia School of Medicine. After three years in Charlottesville (1925-1928), he was appointed Professor of Physiology and Director of the Physiological Laboratories at the New York University College of Medicine, posts which he held until his retirement in 1961.

One may trace Smith's scientific development through phases of more or less pure physical chemistry and cellular

physiology to descriptive chemical physiology of the body fluids. In consequence of these latter studies he became interested in the kidneys as the "Master Builders" of the internal environment. His investigations now became analytical rather than descriptive. Prior to this time Van Slyke and his associates had formulated the clearance concept and Rehberg had used the creatinine clearance in an empirical fashion as a measure of glomerular filtration rate in man. However, it is my opinion that Smith was the first to understand what renal clearance really meant and to appreciate what a powerful tool the clearance concept could be if properly justified. He realized that a precise measure of glomerular filtration rate was central to the study of all renal functions in the intact animal, including man. His knowledge of the comparative physiology of the kidney made him doubt the validity of the creatinine clearance as a measure of filtration rate in man. After all, if the aglomerular fish can secrete creatinine, is it valid to assume that man cannot? Thus began the hunt for an adequate measure of filtration rate which led through a series of studies on the nonmetabolizable sugars to culminate in the justification of the inulin clearance.

From his observations on the clearance of phenol red, a substance first introduced by Rowntree for the clinical assessment of renal function, and from his subsequent studies on the excretion of a series of iodinated urological contrast agents, he developed the methods for measurement of both effective renal blood flow and tubular mass. From titrations of the renal tubules with these latter substances Smith was able to assess the dispersion of tubular blood perfusion relative to tubular mass, and from titrations with glucose, to measure the dispersion of glomerular filtration relative to tubular mass. In the normal kidney he observed a remarkable balance between filtration, blood perfusion, and tubular mass of individual nephrons, even

though these nephrons vary markedly in length and diameter. In the diseased kidney, he noted a far greater dispersion of filtration and of blood perfusion, a fact which correlates well with the morphological changes of hypertrophy, atrophy, and replacement fibrosis affecting glomeruli, tubules, and blood vessels.

These studies on the human kidney in health and disease were begun shortly after his coming to New York University in 1928 and continued to occupy a major proportion of his time and thought for the rest of his life. He was fortunate in finding early in this phase of his career such able and devoted associates as Drs. Goldring, Chasis, and Shannon, and there rapidly developed a degree of intellectual exchange and stimulation between clinic and basic science rare in medical schools of the time or indeed of any time. The evident value, productivity, and excitement of this association of clinic and basic science attracted to him a succession of young physicians who have subsequently attained eminence as investigators in their own right and who have gone on to positions of responsibility in other institutions.

However, Smith was not one to specialize narrowly in clinical physiology; he maintained interests in comparative physiology, paleontology, and evolution. He spent his summers in Salisbury Cove, Maine, dividing his time between studies of renal function in marine animals at the Mt. Desert Island Biological Laboratory and the writing of papers, books, and essays at his nearby cottage. His broad biological interests were responsible for his associations with the American Museum of Natural History (1930-1938), the New York Zoological Society (1938-1962), the Mt. Desert Island Biological Laboratory (1926-1962), and the Bermuda Biological Station for Research (1938-1962), and for his travels as a Guggenheim Fellow to Central Africa (1928) and to Siam and Malaya (1930). His publica-

tions on the lungfish and on body fluid composition of freshwater sharks resulted from these latter scientific expeditions.

In the Department of Physiology of New York University College of Medicine he provided research opportunity and guidance for many young men who have since attained stature in physiology, medicine, urology, and surgery. He also provided an opportunity for others to study medicine while working in the Department of Physiology as instructors or technicians. I am personally indebted to him and to the late Dean Wykoff for my own medical education.

Smith lived for research. Furthermore, he wanted others to experience for themselves the satisfactions which he himself had found in investigation. To achieve this end he made it possible for a number of bright young students to spend a summer in his laboratory in Maine, this long before summer fellowships became the commonplace they now are. Recently a fund known as the Homer W. Smith Fund for Training in Biological Research has been established by a gift from the Science and Arts Foundation of Dedham, Massachuetts, to the Mt. Desert Island Biological Laboratory. Its purpose is to "introduce young people to the joys and frustrations of scientific research," a singularly appropriate memorial. Other no less fitting memorials include the Homer W. Smith Award in Renal Physiology established by the New York Heart Association and the Homer W. Smith Lectureship of the Honors Program of the New York University College of Medicine.

Despite his obvious relish for personal involvement in research and for the training of young medical scientists at both undergraduate and postgraduate levels, he somehow found time to accept and discharge with distinction numerous advisory and consultative responsibilities. During World War II, he was a member of the Chemistry Division of the National Defense Research Committee, Chairman of its Chemical Warfare Sec-

tion, and a Consultant on Biological Warfare to the Chief of the Chemical Warfare Service. For this service, Mr. Truman awarded him the President's Medal for Merit in 1948. As a member of the Committee on Medicine, he participated in preparation of the Bush report entitled "Science—the Endless Frontier"; and thereafter, as Secretary to the Browman Committee Supporting the Bush Report, he worked actively for the legislation which culminated in the establishment of the National Science Foundation. From 1938 until 1953 he was a member of the Postdoctoral Fellowship Board in Medical Sciences of the National Research Council and Chairman (1948-1951) of the NRC-AEC Postdoctoral Fellowship Board (Medicine). He was also Chairman (1951-1954) of the NRC-Fulbright Advisory Committee on Medicine. He was, from 1956 until 1959, a member of the Cardiovascular Study Section of the National Institutes of Health. In addition to these generous services to governmental or quasi-governmental agencies, he also served in an advisory capacity to the Sloan-Kettering Institute for Cancer Research, the Jackson Memorial Laboratory, and the Russell Sage Institute of Pathology. In 1948 he received the Lasker Award for his distinguished achievements in research on diseases of the cardiovascular system and in 1954 was given the Passano Award for his outstanding contributions to research in clinical medicine.

Dr. Smith was elected to membership in the National Academy of Sciences in 1945. He was elected to membership in many other scientific societies, including the American Physiological Society, the American Society of Biological Chemists, the Society for Experimental Biology and Medicine, the Association of American Physicians, the Harvey Society, the New York Academy of Medicine, the Society of General Physiology, Phi Beta Kappa, and Alpha Omega Alpha.

Among the innumerable lectureships which he discharged

with distinction, the Belfield (1938), Porter (1939), Harvey (1940), Kober (1958), and National Institutes of Health (1960) should be mentioned. From 1936 on, he held, among others, visiting appointments at Yale (1936), Hadassah (1950), Bowman Gray School of Medicine (1953), the University of Washington (1955), and Indiana University (1958).

Dr. Smith was a truly great man, a leader, a creative and imaginative investigator, a wise counselor, and a gifted teacher. Although he will continue to live through his scientific papers, books, and monographs as the preeminent renal physiologist of his time, his greatest contributions to medical science will no doubt come through the combined efforts of the many students and investigators whom he trained and influenced. His gentleness, his tact, and his innate generosity will cause him to live on in the hearts of those who knew him well. Those who knew him at all were the richer for the experience.

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KEY TO ABBREVIATIONS

Am. J. Med. = American Journal of Medicine
Am. J. Physiol. = American Journal of Physiology
Biol. Bull. = Biological Bulletin
Bull. N. Y. Acad. Med. = Bulletin of the New York Academy of Medicine
J. Am. Med. Assoc. = Journal of the American Medical Association
J. Biol. Chem. = Journal of Biological Chemistry
J. Cellular Comp. Physiol. = Journal of Cellular and Comparative Physiology
J. Clin. Invest. = Journal of Clinical Investigation
J. Pharmacol. Exp. Therap. = Journal of Pharmacology and Experimental Therapeutics
J. Phys. Chem. = Journal of Physical Chemistry
J. Urol. = Journal of Urology
Kaiser Found. Med. Bull. = Kaiser Foundation Medical Bulletin
Proc. Soc. Exp. Biol. Med. = Proceedings of the Society for Experimental Biology and Medicine

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