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CYRIL NORMAN HUGH LONG
1901—1970

A Biographical Memoir by
O. L. K. SMITH AND J. D. HARDY

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E. N. H. Long

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BY O. L. K. SMITH AND J. D. HARDY

CYRIL NORMAN HUGH LONG, the elder son of John Edward and Rose Fanny (Langdill) Long, was born on June 19, 1901, in a village in Wiltshire, England. Most of his youth, however, was spent near Manchester, where his family had settled in the industrial town of Wigan. He spoke of his childhood often, as if it were of some special importance to the rest of his life.

Mr. John Long was the son of an impressive Color Sergeant in the Scots' Guards. He had shown great academic promise as a boy, but for some reason failed to pursue the life of a scholar or scientist, to which he might have been well suited, and instead entered government service, becoming a Tax Surveyor. As such he was known for his rigid honesty and retiring disposition. On the other hand, he pursued at home a lively interest in history and literature, and his creative energies poured forth in a number of hobbies. Wearing a white coat he experimented in the making of perfumes and jams or inlaid delicate woodwork. He collected rare books and knew some authors personally, notably Joseph Conrad. It may be imagined that his son inherited unusual intellectual ability, versatility, curiosity, and manual dexterity from his father, who encouraged him to be a serious student and to become a scientist. It also seems likely that the Long family set high standards for both moral character and achievement.

Mrs. Long was more of a companion to her two boys than their father. Cyril, as he was then known, often mentions in his diaries (1914–1917) “going out with mother,” perhaps to the library, sometimes to tea or even the theater. He was said to resemble her physically, and it may have been the gentle good nature and flexibility inherited from her that were to distinguish him in later life in the role of teacher and administrator. The Longs were conservative people, and one can only speculate as to how much they might have felt the effects of changing times in England at the turn of the century, but it is worthy of note that they were living near the city of Dickens’ *Hard Times*, the cradle of a great liberal tradition, during a period of social reform and of expanding interest in education. Intellectual life in Edwardian England as a whole, moreover, as has been pointed out recently by J. B. Priestley, had some unique qualities that influenced its youth—first, a distinct optimism that Priestley has termed “an atmosphere of hopeful debate” and, second, a peculiar climate “in which English genius, talent and generosity of mind could flourish.”

As to his own education, Dr. Long was fond of describing to his American grandsons the Wigan Grammar School, where he and his brother Reggie began their studies, as a strict old-fashioned British boys’ school. It was then directed by a Reverend Chambres, a scholar himself, who had the gift of interesting others in learning. Classes were small, especially in the upper grades, and the group became quite competitive, doing well in their outside examinations. Cyril was developing a keen interest in history and soon became known for his exceptional memory and ability to write good essays. The latter he afterward attributed to early experience with corporal punishment, but memories of hard work and even canings seem to have been mellowed by those of the headmaster’s charming wit and of pleasant holidays. For the legendary Mr. Chambres, after a strenuous academic term, would take his boys on a

bicycle or camping trip at his own retreat in Wales rather than seek relaxation for himself. These were pleasant days. Even World War I was remote, although the boys did participate in some civilian volunteer activities and Cyril's first experience in a hospital was probably that of writing letters for wounded soldiers.

Little guessing that his love of sports was to have an unexpected part in his future, Cyril was a skillful and enthusiastic player of soccer or cricket after school. In fact, his father sometimes had to remind him to return home to study. Like most boys, he also loved such robust activities as "tenting," hiking, or bicycle tours. Wet days found him building models or in the library reading—Jules Verne or historical novels, for he was naturally too precise to enjoy literature as an art. His boyhood diaries give glimpses, too, of the early development of certain other familiar aspects of their writer's personality. Facts and figures, such as cricket scores, everyone's term grades, cash flow "in" at a birthday and "out" afterward, are carefully recorded in a boyish hand, observation without comment, much as in the laboratory notebooks that followed in later years. His growing interest in stamp collecting and photography shows the scientist's taste for doing things by himself and also for arranging things each in its own place. No wonder that he became addicted to crossword puzzles in later life. Stamps continued to interest him for many years, so that his final collection was of such high value that eventually it was lost through an unsolved burglary in 1968. He became a skillful and artistic photographer, producing both landscapes and portraits of professional quality. It is interesting to note in view of later events that at the age of fifteen he was already developing his own pictures. He was generally well liked and had several close friends, typically from among the top-ranking students at school. He was always friendly, but most attracted to those with the keenest minds. He said in his mature years that his membership in the Ameri-

can Philosophical Society gave him great pleasure because of the variety of distinguished scholars it brought together.

Cyril continued to do well in school, in such subjects as English, mathematics, French and Latin, geography, Bible, and history. He placed fourth in his class in 1917. In that year, however, he also discovered chemistry, in which he rose immediately to the top of the class. Perhaps it was only natural talent and previous experience in the darkroom that accounted for this new interest, but many years later, when considering the selection and training of young scientists, he wrote of the primary importance of contact with inspiring teachers, "I was attracted at an early age to chemistry, largely by my own fortunate contact in an English school with a science master, who . . . was not a distinguished investigator, but had an enthusiasm for his subject, and a way of teaching it that was so effective that a large number of his students have become scientists." Thus it was that Long embarked upon what he later called the "exciting life adventure" of science. On completion of grammar school he enrolled immediately in the Honours School of Chemistry at nearby Manchester University.

His choice, according to a description by J. F. Fulton, was "a school with a long and distinguished record, especially in the training of men. Founded by Dalton early in the 19th century, such chemists as Sir William Roscoe and Carl Schorlemmer later added great lustre to the school, Schlorlemmer's chair being the first in organic chemistry in England. In the 20th century it helped to produce men like W. H. Perkin, Waynflete Professor of Chemistry at Oxford and his successor at Oxford, Robert Robinson who was appointed in 1930. Long had part of his training under Robinson but principally under . . . Arthur Lapworth."

Years later, when Long had become a champion of accelerated education for talented young American scientists, he wrote that in the British universities "in order to accommodate those

students who enter the University solely for the purpose of obtaining competence in a particular field the Honors Schools are provided. To my mind this is an excellent way to recruit scientists, and while it is true that they may emerge somewhat deficient in what is called a liberal arts education, they are likely to be exceedingly competent in their area of study. You may also be sure that only those who want to do nothing else but pursue their life work in a particular field will be attracted to such an exacting course of study."

Long might have become a different sort of young man if he had gone to Cambridge, which was at first considered, but he seems to have been satisfied to commute to Manchester and to live at home with father and mother. At any rate he obtained a thorough training in both inorganic and organic chemistry, prepared his first two publications on the subject of the Friedel-Crafts reaction, and received his Bachelor of Science degree with first class honors in chemistry in 1921. Now twenty years of age, he was apparently well on the way to a career as an organic chemist when something unexpectedly set him off in quite a different direction. His own version of what happened is as follows:

"During my years in the School of Chemistry I had become interested in organic chemistry, particularly in that of carbohydrates, and had thought that I might devote myself to this subject after graduation. However, one day in 1921, I was asked to see A. V. Hill, the newly appointed Professor of Physiology at the University. He told me that he was working on the physical and chemical changes underlying muscular contraction, and that the latter was associated with the breakdown of glycogen to lactic acid. He needed the assistance of a chemist to follow these changes both in animals and in the blood of humans who were exercising. I must say that my first reaction was not too enthusiastic, I had had but little experience in biology, and in those days the efforts of the so-called biochem-

ists were not held in too high regard by many of their colleagues in pure chemistry. I was used to dealing with substances that could be crystallized, whose physical constants and chemical properties were predictable. The heterogeneous, messy and unknown properties of extracts of cells or of blood which this investigation required me to analyze seemed to offer nothing but a struggle against large odds. Nevertheless, as Professor Hill talked about the enormous possibilities for the understanding of living processes that the methods of chemistry and physics were able to offer, I began to be caught up in his enthusiasm and vision. I accepted the great opportunity he offered me and in due course wondered why I had not had the sense to see for myself the challenge and excitement that these 'messes' offered to young students of chemistry and physics; that they were indeed the only keys that would unlock the mysteries of living cells and organisms. . . .

"When I began my work with Hill and his colleague Lupton, I soon began to suspect that their interest in me had not been entirely due to my extensive training in chemistry. I was at that time an enthusiastic player of football, field hockey, and cricket and this interest was soon put to practical uses by my superiors for I found myself running up and down stairs, or round the professor's garden while at intervals healthy samples of blood were withdrawn from my arms. When I had recovered from my exertions I was asked to sit down and analyze these for lactic acid."

Professor Hill's story is a little different and gives Long credit for more initiative:

"Long came and joined me in 1922 in Manchester. It was his own idea. He had just got a first class degree in chemistry there and I think he possessed a microscope which set him thinking about biology. . . .

"Long was a charming fellow to work with—there was quite a party of us—and enjoyed attempts to break world records of

rate of oxygen consumption during a total oxygen debt after severe exercise to which my colleagues and I were rather addicted."

Hill's reputation must have preceded him to Manchester, and in view of later patterns of behavior it seems quite likely that Long got up courage to seek him out. He knew the use of a microscope well, for they had studied one at Wigan Grammar School, and he had taken bacteriology as an undergraduate. He was, in addition, probably familiar with some other biology courses offered the chemists. The classical work done in 1907 by F. G. Hopkins and W. Fletcher (who had been Hill's tutor at Cambridge), describing the production of lactic acid from glycogen during contraction of the isolated frog muscle, must have excited his curiosity, especially since he was already interested in the chemistry of carbohydrates.

Although neither account mentions it specifically, Long's next course of study took him to the medical school at Manchester where, having received a scholarship, he began his work in October of 1921. We now know that although he was studying for his M.Sc., Hill encouraged him to qualify also for the medical examinations because he could see his young associate's "mind was already bending towards medicine."

In the meanwhile the conversion of Long the chemist to Long the physiologist took place rapidly and, after receiving his master's degree from Manchester in 1923, he continued on with Hill to join Starling's department at University College, London, for the next two years. Of this move he wrote: "[There was] freedom in those days to take advantage of unexpected opportunities and to choose one's own course. Today's young scientist may find himself working in a very limited area. . . . There are tremendous pressures on him, mainly financial ones, to stay within a specialized area. When I was a Demonstrator in physiology [at University College] in London, my salary was equivalent to only \$250 a year, but I was free to work in any

area of physiology that interested me. I think it would be impossible to duplicate my career today."

Eight papers were published by Long alone or in collaboration with Hill and others on correlating what was then known about the chemistry and physiology of isolated muscle with what could be observed after exercise in the whole animal, particularly man, and later on about more clinical aspects of the same subject. It is interesting to note that this early work was also carried out under the watchful eye of Walter Fletcher, by now director of the Medical Research Council, and that the papers were usually submitted to the exacting Professor J. N. Langley of Cambridge (owner and editor of the *Journal of Physiology*), who wouldn't have hesitated to return them completely written over in red pencil! A further connection with Cambridge was made during a summer when Long worked in Joseph Barcroft's laboratory.

The years with Hill were important, too, not only for acquiring technical training, but also for leading to the development of a philosophy. The growth of biological science in England at the turn of the century owed much to the Cambridge school of physiologists, under Michael Foster and later Langley, where Hill had received his own training. Under Fletcher's supervision Hill had worked in an odoriferous, unglamorous cellar side by side with Lucas and others, for the physiology laboratory at Cambridge in those days was crowded with many "giants per square foot." Thus it is not surprising to find Long assimilating some progressive ideas about science and education. Always a staunch adversary of Victorian utilitarianism, he quoted Sir Edward Appleton in 1955—"Knowledge and insight are sufficient reward in themselves"—to express a view that has not enjoyed universal popularity as the century progressed. Also, Long began to believe, as Hill and Hopkins did, that the greatest discoveries are made from astute observation as a matter of chance—"things just happen" rather than being planned. Fur-

ther, he believed that the function of the scientific mind is, simply as it says in the dictionary, to revise "accepted conclusions in the light of newly discovered facts." All of this means that the most important piece of equipment in the laboratory is the scientist himself, and it demands that the scientist be given, as Long would say, the minimum of requirements and the maximum opportunity. This was the state that suited his own temperament so well. It might also be observed that such individualized endeavors thrive best in a climate of friendship and the strong personal bonds that were to provide an important ingredient in the course of Long's own career.

Leaving his home district and parents for the first time may have been difficult for Long, but once settled in London he soon made many new friends. A gala farewell party a few years later at the Astoria tells of their high regard for him, and his fondness for his companions is recorded in many snapshots showing them in the laboratory, enjoying parties, or boating together. It was not long before his interests widened, and his responsibilities were increased when it became evident that their colleague Harvey Lupton was dying of cancer. Interestingly enough, a letter from Lupton from the nursing home suggests that some of their techniques for studying exercise in man be applied to diabetic patients.

It is not unlikely that Long was himself already thinking about the subject that was ever after on his mind: the syndrome of diabetes and how the various endocrine glands play upon metabolism during its development. He had a great admiration for Ernest Starling, and it is possible that his interest in diabetes dates from 1924 when a photograph of Long was taken with a dog depancreatized by the professor (Banting's and Best's discovery of insulin was still only three years old and was receiving much attention throughout the world). Having appreciated the advantages of applying chemistry to physiology, Long again began to apply what he knew of one discipline to another,

clinical medicine. The result was "The Metabolism of the Diabetic Individual During and After Muscular Exercise," written with K. S. Hetzel from the Department of Medicine. About this time he discovered Graham Lusk's *The Science of Nutrition*, which was to influence his work for many years to come. He was also seeing a great deal of his friend Alan Parkes, who was studying medicine. Their discussions together led to another clinical paper, on fetal reabsorption, Parkes's interest at the time.

Accordingly, A. V. Hill arranged an opportunity for Long to return to his medical studies: "In 1925 Jonathan Meakins, Professor of Experimental Medicine at McGill University, Montreal, asked me if I could recommend somebody to join his team there. This led to Long going to McGill where he continued experimental studies in the intervals during his study of clinical medicine."

During the next two years Long held the post of lecturer in medical research in the Department of Biochemistry at McGill. Upon receiving his M.D.C.M. degree, in 1928, he took charge of the medical laboratory at the Royal Victoria Hospital for the Department of Medicine, becoming assistant professor of medical research at McGill in 1929. Writing of the talented and kindly Meakins in an obituary in 1959 he said, "My acceptance of this opportunity was perhaps the most fortunate decision I have made in my scientific career." While it would have been easy for Long to enjoy moderate fame (a contemporary newspaper article refers to him as a "noted physiologist"), he had detected in the McGill offer, quite apart from the opportunity to get his medical degree, some of his favorite ingredients. First of all, Dr. Meakins had written that there would be "no interference on the part of others" with one's own laboratory work. In addition, Dr. Meakins, who had lately arrived himself as the first full-time chief of medicine at McGill, had some interesting new ideas about the future of medicine. His posi-

tion included the directorship of the University Clinic, which, as it turned out, was "one of the earliest attempts to integrate the rapidly developing basic medical sciences into the fabric of internal medicine." Nowadays, when the sick enjoy daily the fruits of such collaboration, it is hard to believe that the concept of a laboratory where the clinician could work side by side with the pure scientist was, in 1925, a revolutionary idea. As might be expected, Long's previous success as a chemist venturing into other fields made him quick to appreciate the potential of the new facilities at the Royal Victoria Hospital. Finally, might he not find congenial and stimulating companions in the new world?

He was not disappointed. Mrs. Meakins met him at the ship, installing him as a houseguest until he could get settled. Indeed, his laboratory notebook was hardly interrupted by its trip across the Atlantic. While the publications of the next seven years covered a variety of topics as Long gained knowledge of medicine and collaborated with others on the staff, it is interesting to note that throughout he was still preoccupied with the fate of lactic acid in health and disease and the neuroendocrine control of carbohydrate metabolism. "These were fruitful and exciting days," he wrote, "as we pursued our particular interests and at the same time exchanged ideas and talked shop among ourselves and clinicians and medical students who gradually began to drop in." Typically, he became treasurer of the Fund for Afternoon Tea, a daily social function that attracted a variety of stimulating associates and was to become a ritual in all his future laboratories.

Hill came to visit and later reported to Long's proud father, "He is extremely happy and doing very well indeed. . . . All his colleagues seem to love him and they have great hopes for his future. He seems to be taking to his clinical work like a fish to water." Hill also tells how Long's playful colleagues asked him questions they knew he couldn't answer on his final

medical examinations, filling him with "dismay," only to announce later that he had "passed with Aggregate Honours!" Certainly his ability was appreciated. Dean Charles Martin was able to describe him in a recommendation as "excellent teacher, pleasing and stimulating personality, fertile mind, original work speaks for itself."

The easy informality on the new continent apparently agreed well with Long. Perhaps that is why he became "Hugh" instead of "Cyril" to his new friends. The "heartily democratic" manners (according to Priestley) of the people from manufacturing towns like Manchester during the early twentieth century may explain why Long later adapted more readily to life in the United States than do many of the British and why he seemed happily disinterested in class distinctions. He gained some reputation for youthful gaiety among his fellow medical students, although one can hardly imagine his having much time for such things considering the burden of work he carried at the time. He was changing, too, becoming more teacher than student, more leader than follower, and guiding his first graduate students.

One must agree with Yale colleague John Fulton that "his educational career has been peculiarly felicitous," for he now superimposed on his basic chemical and physiological *modus operandi* the clinical point of view, which became his permanent outlook, although he was not to enter the practice of medicine. He was always the medical man first, and a quietly compassionate one, sometimes exasperating his more zealous, less humanitarian associates. Years later (1950) his final admonition to the medical educators of Japan was to remember "the doctor is the servant of the sick and must endeavor to get him well."

It may be pointed out here that Long's first ties in the United States were with the clinical societies (he was president of the American Society of Clinical Investigation in 1944) and

that he soon became known for his ability to restate the problems of disease more clearly to physicians in biochemical or physiological terms. Driven by the curiosity that earlier had sent him to Hill, the young medical student, unabashed, had struck up a correspondence with some famous figures—Carl Cori, W. B. Cannon, and Graham Lusk himself. It was with some annoyance that he received a typical reply from Lusk in which this hero casually discounted Long's meticulous results as due to a leaky apparatus! Nevertheless he had gained enough confidence in his own accomplishments to present a paper to Manchester University for a D.Sc., which was bestowed on him in 1932, shortly before he left McGill.

Dr. Meakins was to make one further contribution to Long's happiness, that of introducing him to Hilda Jarman, who was to become his wife. Having encountered a group of attractive young women from Calgary starting out on a holiday abroad, and knowing Long was on his way home to England for a visit by the same ship, Meakins couldn't resist arranging what developed into a shipboard romance. The wedding was at the bride's summer home in Vancouver in 1928. Hilda Long, an attractive, intelligent, and practical person, was to have an unusual appreciation of her husband's important contributions to science and human welfare. In addition, she shared his enjoyment of the social side of life, and she was to bestow gentle concern and friendship in the future on hundreds of his students and associates.

Although those who knew Long were convinced of his future success, the newly formed George S. Cox Research Institute at the University of Pennsylvania would perhaps have seemed an unlikely spot from which to make an important scientific discovery when he left McGill to become its director in 1932. The new arrivals were greeted by a modest suite of rooms, walls bare except for a plaque advising the occupants that the purpose of the institute was to "find a cure for dia-

betes." "A rather overwhelming assignment for a young man," Long recalled later. Undaunted he immediately set about exploiting the advantages of this position as he saw them: great freedom, continued close contact with clinical medicine without, however, direct responsibility for patient care, and, finally, the stimulating association with physiologists A. N. Richards and Detlev W. Bronk, friends of his in the preclinical science departments. (The Longs had renewed ties with physiologists in 1929 when returning from a trip to England by the same ship that brought Hill and all the other noted Europeans to attend the International Physiological Congress in Boston.) His responsibilities in the laboratory, moreover, were to be shared with a skillful clinician from the department of medicine, Francis Lukens.

In spite of evidence to the contrary it was generally agreed in those days that all the symptoms of diabetes mellitus were simply due to the underutilization of sugar because of an insufficient supply of insulin. Although Long came from a school that upheld the pancreatic origin of diabetes, he immediately appreciated the importance of the discovery a few years before by Bernardo Houssay that the removal of the pituitary gland produced a remarkable amelioration of experimental diabetes, clearly demonstrating the participation of at least one extrapancreatic factor in the diabetic syndrome. Thinking of the task ahead, Long and Lukens remembered the clinical observation that diminished function of the cortical portion of the adrenal gland lowers the blood sugar. Knowing also that removal of the pituitary is followed by adrenal atrophy, they set about investigating the possible role of the adrenal cortex in the Houssay preparation.

By early 1934 Dr. Lukens was able to prepare cats not only pancreatectomized but having both adrenals removed as well. To the two scientists' delight, the first such cat lived eleven days, or about twice as long as the usual diabetic cat; its blood

sugar values were actually lower than normal in spite of its receiving no insulin whatsoever. They knew immediately that they were on the right track.

Long said afterwards, "Our feelings of achievement and excitement in those spring days now nearly 30 years ago [*sic*], when we saw those cats alive and well long after their controls had died, are still very vivid in my mind. It is one of the great though far too infrequent rewards of research to realize that you have made a lasting, albeit small contribution to knowledge. To be privileged to do so is an experience that remains with you long after your work has been expanded and incorporated in the greater achievements of your successors."

A short note appeared in *Science* in June 1934; as news of their discovery spread in the months that followed, Long and Lukens carefully extended and confirmed their observations. The evidence suggested that (1) the amelioration of diabetes in their animals was because the cortex of the adrenal had been removed, not the medullary or "nervous" portion of the gland as had usually been suggested and (2) that indeed the lessening after adrenalectomy of the copious amounts of sugar in the body so typical of diabetes might best be attributed after all to a reduction in sugar production from other sources, notably body protein. These conclusions have since been confirmed many times, not only in Long's own laboratory, as more highly purified hormones became available, but also, as the years have passed, by the work of others throughout the world.

At the time, however, these were conclusions that might not be accepted joyfully by all. The history of the study of diabetes is one of intermittent bitter contests, often unfortunately sparked by speculation on inconclusive evidence. But Long, by temperament and training, was never inhibited by old ideas. On the contrary, he delighted in the assumption of a new point of view, refuting erroneous work and bolstering his arguments with sound facts. He was an instant success as a speaker, sharp

in debate but modest as he faced the first imposing scientific meetings. His success prompted a new friend (also a biochemist turned physician), J. P. Peters of Yale, to write, "I hear about your talks at every corner from those who have been stimulated by them. It was good to have someone with a really objective attitude discuss an endocrine subject."

Long's most important contribution, then, was not that he and Lukens had "cured diabetes" by adrenalectomy—for such a naïve idea was never entertained—but rather that the syndrome of diabetes itself was reconsidered in the light of newer knowledge of the parts played by the pituitary and other ductless glands in the events that follow pancreatectomy in animals. Long gave substance to the concept that the "balance of the endocrine glands" was related to the "diseases of metabolism." In 1936 he proposed to the American College of Physicians that "the clinical condition that follows hypo- or hyperfunction of an endocrine organ is not merely due to the loss or plethora of that particular internal secretion but is a result of the disturbance of the normal hormonal equilibrium of the body"—still, almost forty years later, perhaps the most important single idea in endocrine research.

The rooms of the new institute in Philadelphia were well filled now. Working in the laboratory were Lukens, Gerald Evans, and a young physiology student, Edith Fry, as well as other students and visitors. Long's "office" was a desk at the end of a corridor where he received the distinguished guests who came to observe, C. H. Best and H. M. Evans as well as Professor Houssay. He received invitations from many places, including one to visit Elliot Joslin in Boston. Professor of Medicine Alfred Stengel wrote him later that those four years at the Cox were nothing short of "a brilliant performance."

It was inevitable that Long would attract the attention of those seeking a candidate for the chair at Yale University vacated recently by the death of the celebrated biochemist

Lafayette Mendel. As a result of the efforts of Peters, who was specializing in diabetes in the Department of Medicine, and of the distinguished neurophysiologist John Fulton, Long moved to New Haven in the fall of 1936 as professor of physiological chemistry. Although Fulton's report for the committee praised his teaching and administrative ability, which had already become evident at the Cox Institute, it is most interesting for its evaluation of his scientific work. It states that Long has "perhaps more than any other contributed to the disentanglement of the confusion that reigned between the functions of the various endocrine glands and . . . metabolism and had put this on a sound scientific basis."

For his part, Long wrote this rather interesting acceptance to Dean Stanhope Bayne-Jones: "Not only my own future but also that of the subjects in which I am interested are to be best served by accepting your invitation." Privately he felt some trepidation. He was only thirty-five years old, and his accomplishments were unknown to many outside his field. Nevertheless, as A. V. Hill correctly predicted in a congratulatory letter, he need not have feared to follow the famous Professor Mendel, for his own interdisciplinary training uniquely fitted him for the needs of the future.

Long remained at Yale until his retirement thirty-three years later, first as professor and chairman of the Department of Physiological Chemistry, receiving the appointment as Sterling Professor in 1938. (His department, renamed the Department of Biochemistry in 1952, was the first department of biochemistry in the United States.) Later, Long became chairman of the Department of Physiology, having twice assumed responsibility also for the Department of Pharmacology as interim chairman, as well as serving as chairman of the university's Division of Biological Sciences. From 1947 to 1952 he served as dean of the School of Medicine, having already been acting dean briefly in 1943. From the first he took an active part in

the affairs of the School of Medicine and joined in the life of the Yale community, being immediately well liked and respected. His department published fifty-seven papers in 1937-1938 and entered into many new outside activities under his leadership.

Long's years at Yale saw changes in the university, some the result of World War II, others economic and social, but it was fortunate perhaps that his early years and a good part of his deanship corresponded with the presidency of Charles Seymour. They had much in common, and Cambridge-educated Seymour appreciated his British colleague. Furthermore, the Seymour administration was noted for its enthusiastic support of science in general, a fact that on at least one occasion kept Long at Yale. Long participated in the overall reorganization of the teaching of biology at the university and gave promise that he would be as inventive and unconventional in administration as he had been in the laboratory. He became an ardent supporter of plans to unify the basic science departments of the university so that undergraduates, graduate students, and medical students would be enrolled side by side, perhaps not even deciding what degree to take until a later date. These plans were carried out only in part. He consistently urged the support of unusually gifted students, to free them from required work and from pressures (mainly financial) to finish quickly, and to allow each to chart his own course. Admittedly, the champions of such freedom were to suffer mounting frustrations in the mid-century United States as the young scientist became more and more lost in vast impersonal projects, often entirely taken out of private hands by the government.

Long found much to do at Yale in the thirties and forties and much to admire, chiefly those elements introduced previously under that dynamic innovator in medical education, Milton C. Winternitz, dean from 1920 to 1935. The so-called "Yale system," with its emphasis on individual achievement

and self-reliance, was of course very much Long's own style. His arrival coincided with a period of modernization of teaching in the preclinical years in which he took an active part. He worked assiduously for his belief that the chemistry and physics of cellular function were the future of medicine and must be taught to the students on an advanced level. Fortunately he was also wary of teaching too many facts: "independence of thought and a capacity to form judgments will be required of the physician all his life, while techniques and the interpretation of information are always changing" and "the secret of success in medicine is an enquiring mind. Take nothing for granted, see and find out for yourself" rather than rely on the authorities, who don't, after all, have a "monopoly on all future ideas."

Long usually participated in the teaching of courses in his departments and also continued to meet with small groups of students until his retirement. Sometimes, he admitted, these conferences lapsed into an unscientific discussion of baseball, for he was still an avid sports fan. He once declined a strictly research post because "teaching is an important task." Of lecturing he admitted in 1942, "Indeed I can honestly say that since I have started to teach I have worked harder at elementary biochemistry than I ever did when a student." The fruits of this labor were lectures, later covering endocrinology, that were attended by such large audiences that around 1950 they had to be moved to a special auditorium. His lectures may have been a shock to the neophyte for whom they were intended, however, because of his preoccupation with the history of endocrinology and various unorthodox points of view. Surprisingly, the sense of humor that animated his private conversations, often making him a genial host or welcome arrival at a dull party, almost never surfaced in his formal lectures. In this he was in marked contrast to some of his lively contemporaries at the school. Perhaps he wished merely to emphasize the seriousness with

which those of his training viewed their task. His interest in medical education was not a transient one, and he followed the careers of the medical students after graduation. He was proud of their high marks in National Board Examinations and celebrated their other achievements as much as he did those of junior members in his own departments. He took particular satisfaction in the large numbers of both groups of former students who became professors and department chairmen at other schools throughout the country, for he thought that the most important responsibility of the school to the community was to provide leadership in teaching and research. That his own leadership should ultimately be recognized by the endowment of a chair in his name at Yale devoted to endocrinology and metabolism was therefore one of the most gratifying of the many honors he received. One cannot consider the list of his former students, moreover, without being impressed by the large number of professional women whom he encouraged and trained, starting with his first graduate student in Montreal, Eleanor Venning. At that time women were not accepted universally in the laboratory nor as physicians.

Maintaining high standards in education and research had not been easy during World War II, and the pressures of the postwar period on medical schools were combined with mounting economic problems. Thus when Long was asked to become dean in 1947, the School of Medicine was facing a grave crisis. In fact, there were rumors that it might close entirely—hardly happy circumstances under which the new dean was to take office! Needless to say, the school did not close, largely because of extraordinary efforts to reach a compromise on the question of how to relieve the university of the responsibility for the entire deficit of the New Haven Hospital, which was becoming an alarming drain on Yale's educational funds. Dean Long was one of the architects of that agreement and was responsible as well for numerous other improvements in service and economy, notably the centralization of clinical laboratories.

While the most striking accomplishment of Long's term as dean was the lowering of the school's deficit by one-half, there were many other advances, for example: 1) the broadening of the responsibility of the School of Medicine in the community both by the offering of postgraduate medical education and by the initiation of measures to establish the school as the medical center of Connecticut, and 2) the improvement of personal relationships within the school itself. Perhaps this latter was due to the sincere attempts to reach a consensus among the faculty on important questions without overlooking anyone's private opinion, an awesome task considering what strong personalities were involved. It would have been an impossible one without the maximum of mutual respect that fortunately seems to have prevailed. In describing Long's term of office one of his former colleagues singled out his sympathy for a fellow department chairman's problems (for the deanship was only a part-time job in those days), his availability in spite of "onerous burdens," and his continued interest in the care of patients, particularly where basic research applied to clinical problems.

For the future Long hoped for medical curriculum revisions, including a forward-looking expansion of the sections on epidemiology and public health. He was the first dean to express concern for the health of the medical students then living in tenements and pointed out the urgent need for a modern dormitory. Although it made newspaper headlines, one of his more radical proposals to provide more and younger doctors never gained acceptance by the university. The proposal was for a cooperative program between the School of Medicine and Yale College to grant the M.D. degree after only five years of study instead of the usual eight. Similar plans are now being adopted by many medical schools throughout the country.

Since the school had been on the brink of disaster, it is amazing to hear from Long's professor of surgery that the five years of his deanship were "thoroughly happy years professionally, perhaps in part because we were both new in our

respective positions with high hopes for the School and a minimum of accumulated frustrations." Another associate described the hospital crisis thus: "I am impressed with the stimulation, fun and pleasure that both Hugh and I got out of our administrative responsibilities. I recognize that this is almost inconceivable today. . . ." Perhaps, after all, what he gave to that difficult term of office was a little of the "atmosphere of hopeful debate."

No description of those days of stringent economy would be complete without reference to the semblance of a gracious social life that the Longs and their friends somehow continued to bring to Cedar Street. Thus the traditional afternoon teas popular since the Winternitz days at the medical school were enthusiastically continued. Faculty wives presided, and the refreshments were provided by funds raised annually at a gala ball arranged by the students. It all required some effort, but succeeded in bringing the medical community together in ways that were not entirely academic.

When Long's term elapsed, in 1952, he left with relief, for he believed the deanship should be a full-time job. At this time he moved from biochemistry to the physiology department where he served as chairman until 1964, remaining as Sterling Professor until he became emeritus in 1969. There, he could be found in an office typical of his Yale days. It was, like himself, a blend of old and new styles. Visitors sat upright on ancient, durable chairs that scraped on bare floors because elaborate furnishings were considered extravagant. Shiny office machinery, on the other hand, had been selected from the latest models. One saw him over a very neat but undistinguished desk, hair prematurely white since the thirties above a rather long, thin face with sharp, closely set dark eyes and a slightly deviated nose, the result of his athletic past. An adroit practitioner of the art of conversation, he was a restless talker, leaning back gently in his chair to pick a book from the shelf, or

pacing about the room, stopping periodically to assume a characteristic pose—bent at the waist, one hand on hip, the other busy with pencil or chalk.

Although administrative responsibilities took more and more of the actual work out of Long's hands, there can be no doubt that he continued to play a large part in the direction of his laboratories at Yale. He enjoyed the company of his co-workers and sought them out to discuss problems. His special flair for the application of a new or unusual method to an old question continued to characterize his work, and he drove his young associates to thorough calculation and recalculation, interpretation and reinterpretation. At the same time, like Gowland Hopkins, he had the tolerance for youth and inexperience that is a mark of greatness, the ability to listen patiently to salvage something worthwhile from the most inept presentation. The audiences were always amazed at his respect for the value of the older medical literature, of which he had an encyclopedic knowledge. Final evidence over the years that he maintained full command of his subject is found in the series of sparkling, unbiased review articles and talks with which he inspired a new generation of endocrinologists. He developed a worldwide audience, and in recognition of his accomplishments was elected to the National Academy of Sciences in 1948. He participated actively in a number of professional societies, but served none more faithfully than the Endocrine Society, of which he was president in 1947–1948.

The central theme of Long's research remained the endocrine control of metabolism, which is "far more complex than appeared possible a few years ago." On the basis of work carried out with Miss Fry, who had come with him from Philadelphia, and a medical student, B. Katzin, he was able to describe quantitatively for the first time the biological properties of the adrenal cortical hormones, and a classic paper was published on this subject in *Endocrinology* in 1940. The availability of

more highly purified hormones and the use of partially depancreatized rats made possible the demonstration of exacerbation of the diabetes previously attenuated by adrenalectomy. This work, moreover, definitely established the effects of the glucocorticoids on protein as well as on carbohydrate metabolism, laying the foundation for future studies on the popular topic, the therapeutic effects of cortisone and related drugs on man. Reexamination of the possible hypophyseal factors participating in the diabetic syndrome also led toward the isolation of prolactin (with A. White), of adrenocorticotrophic hormone (with G. E. Sayers), and of growth hormone by Alfred and Jane (Russell) Wilhelmi; furthermore, the development of the adrenal ascorbic acid bioassay for pituitary adrenocortical hormones in Long's laboratory and the resulting studies of the latter continued for many years to constitute some of his most important contributions. During World War II his group, under Frank Engel, investigated the role of the catabolic effects of the adrenal cortex in hemorrhagic shock. Afterward the laboratory returned to diabetes and related topics, particularly obesity, and continued the search for the nature of the effects of the adrenal cortical hormones on intermediary metabolism. The work of Long's later years, moreover, is distinguished by a surprisingly youthful originality. For example, undaunted by the most formidable procedures devised by physiologists, he described with T. Hiroshige in 1964 a procedure for the "visceral preparation" in the rat.

With students in all parts of the globe, with activities in remarkably varied professional societies, and with the wide recognition he received for his achievements in basic science, Hugh Long was destined to have more than a local influence on the course of medical science in his time. Some measure of this was a consequence of the service he gave to the government of his adopted country, which urgently needed him as a consultant during World War II. His desire for citizenship in the United States was granted in 1942. The story is told that, according to

his usual custom, he came to the examination for naturalization very well prepared. When asked some minor questions about American history, he astounded his audience with a twenty-minute scholarly talk on the subject.

No native-born American scientist gave his energies more willingly to the task of advising the government on medical research. Long worked under various government offices starting in 1937, when he had first joined the Endocrine Research Committee of the National Research Council. His post as deputy chief of the Division of Physiology of the Office of Scientific Research and Development assured permanent contact with physiologists and took him to visit many of their laboratories (for example in 1943) where a great deal of the best work in endocrine research was then in progress. While primarily concerned with subjects relating to the endocrine glands, his involvement broadened as he became more experienced in the administration of medical research and education.

Long had witnessed at close range the postwar surge of public interest in research in medicine, which was responsible in part, it must be admitted, for the success of laboratories like his own. He had, nevertheless, several opportunities to survey the less fortunate effects of government support of science and of medical research. Among them he cited the tendency of the government to focus funds on the eradication of certain diseases, diverting doctors from teaching and the practice of medicine and neglecting the general support of institutions engaged in the discovery and training of the gifted new scientists necessary for more basic research.

Long took some memorable trips abroad in the interest of medical education. The first was as leader of a harrowing (because of the outbreak of the Korean War) but successful advisory mission to Japan in 1950. In 1965 he joined a similar mission to Egypt for the Agency for International Development. An invitation to return to Japan for the Atomic Bomb Casualty Commission was also gratefully accepted, since he was an enthu-

siastic tourist and had ties in both Japan and Hawaii. He took a rare sabbatical to assist in the founding of a new medical school in Honolulu in 1964.

Such assignments were rewarding in new associations, ideas, and friendships, but were time-consuming and exhausting and performed at considerable sacrifice. Following one trip to Washington in October of 1960, after a strenuous summer of meetings abroad, Long entered the hospital with a severe myocardial infarction. He recovered in time, however, to receive in person an honorary degree from McGill University in June of the next year. He lived almost ten years longer, a life sometimes dissatisfying professionally as the elements of his philosophy were inevitably challenged, but full of honor and never dull. Upon reaching the age of retirement, in 1969, he was appointed a fellow of the John B. Pierce Foundation's Yale-affiliated laboratory, where he continued his research in the endocrine control of metabolism as related to environmental physiology. Although suffering increasing physical limitations he took pleasure as usual from work, friendship, and family life, for he was always happiest at home or traveling abroad with his two daughters. His close relationship with them is more evidence of his extraordinary strength and discipline when one considers the heavy demands of his work during the years of their childhood. One of his proudest moments was when his younger daughter, Diana, received her Ph.D. in the History of Science and Medicine from Yale. After his daughters married and he became the delighted grandfather of six grandchildren, summers in Maine continued to unite him with his children. There, while fishing with a young grandson on a beautiful summer day, his heart finally stopped, ending a remarkable career.

In accounting for a life so full of meaning and accomplishment one is struck in the first place not only with the optimism but also the good will, tolerance, and mutual enjoyment with which this older generation, particularly in Britain, endowed

its scientific work. It was before, as Priestley observes, "we had to move into a world largely alien to the English temperament." Second, while the old world was small enough for individuals to have importance, it was large enough to accommodate the freedom that Long so valued and used to such advantage in his own career. At every crossroad he consistently chose freedom over security and material gain. Third, much of Long's success, both in the laboratory and as an administrator, stemmed from his breadth of knowledge, his appropriate choice and effective promotion of the original, neglected ideas of others. He was a nonspecialist with the broader understanding possible before the current necessity of specialization. While today, because of overwhelming advances in the body of scientific knowledge itself, there is "more emphasis on the accumulation of facts than on the ability to comprehend them (D. W. Bronk)," it seems highly unlikely that Long and Lukens would ever have fully appreciated the relationship of the endocrine glands to the biochemical changes of diabetes mellitus if they had not had wide experience in clinical medicine. Fourth, in Hugh Long's day there was more leisure for maturing, more time for contemplation and, finally, no one was ashamed, in the words of A. N. Whitehead, to take "an active interest in the simple occurrences of life for their own sake."

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CHRONOLOGY AND MEMBERSHIPS

- 1901 Born June 19, Nettleton, Wiltshire, England
- 1918 Wigan Grammar School
- 1921 B.Sc., Manchester University; M.Sc., 1923; D.Sc., 1932
- 1923–1925 Demonstrator in Physiology, University College, London
- 1925–1932 Lecturer and Assistant Professor of Medical Research, McGill University
- 1928 M.D., C.M., McGill University
- 1928 Married to Hilda Gertrude Jarman. Children: Barbara Rosemary (Mrs. Richard P. Simons), Diana Elizabeth (Mrs. David D. Hall).
- 1928–1932 In charge, Medical Laboratories, Royal Victoria Hospital, Montreal
- 1932–1936 Director, George S. Cox Medical Research Institute, and Assistant Professor of Medicine, University of Pennsylvania
- 1942 Became an American citizen
- 1936–1970 Yale University: Chairman, Department of Physiological Chemistry, 1936–1951; Professor of Physiological Chemistry, 1936–1938; Sterling Professor of Physiological Chemistry, 1938–1951; Director of Graduate Studies, Department of Physiological Chemistry, 1937–1948; Chairman, Department of Pharmacology, 1939–1941, 1952–1953; Chairman, Division of Biological Sciences, 1939–1942; Fellow, Calhoun College, 1940–1970; Dean, School of Medicine, 1947–1952; Chairman, Department of Physiology, 1951–1964; Sterling Professor of Physiology, 1951–1969; Director of Graduate Studies, Department of Physiology, 1952–1961.
- 1936 M.A. (Hon.), Yale University
- 1946 Sc.D. (Hon.), Princeton University
- 1948 Army–Navy Certificate of Appreciation
- 1950 Squibb Award, Endocrine Society
- 1951 Banting Memorial Medal of the American Diabetes Association
- 1955–1956 Fellow, John S. Guggenheim Memorial Foundation

- 1956 Schering Scholar, Endocrine Society
 1959 Modern Medicine Award
 1959 Scientific Award of the Pharmaceutical Manufacturers Association
 1961 Sc.D. (Hon.), McGill University
 1962 M.D. (Hon.), University of Venezuela
 1964 Medal of Hiroshima University (Japan)
 1964 Visiting Professor, University of Hawaii
 1964 Faculty of Medicine plaque, Tokyo University
 1966 C.N.H. Long Professorship established, Yale University
 1969-1970 Fellow, John B. Pierce Foundation
 1970 Died July 6

Member American Diabetes Association, American Philosophical Society, American Physiological Society, American Society for Clinical Investigation, Argentine Society of Biology, Association of American Physicians, The Biochemical Society (Great Britain), British Diabetic Association, Connecticut Diabetes Association Inc., Connecticut State Medical Society, Endocrine Society, Fulton Society, Horseshoe Club (London), International Brain Research Association, Interurban Clinical Club, National Academy of Sciences of the United States of America, Peripatetic Club, Physiological Society (Great Britain), Society for Experimental Biology and Medicine, Yale Medical Society. Editorial Board of *American Journal of Physiology*, *Endocrinology*, *Journal of Applied Physiology*, *Physiological Reviews*, *Proceedings of the Society for Experimental Biology and Medicine*, *Yale Journal of Biology and Medicine*. Board of Governors, *Methods in Medical Research*. Committee member or Consultant for Armed Forces Institute of Pathology, Atomic Bomb Casualty Commission, Atomic Energy Commission, Armed Forces Quartermaster's Food and Container Institute, Department of Health, Education and Welfare, Institute for Defense Analyses, National Research Council, National Science Foundation, Office of Scientific Research and Development, President's Scientific Advisory Committee, United States Army, United States Public Health Service. Fellow, American Academy of Arts and Sciences and College of Physicians of Philadelphia.

Articles and obituaries about Dr. Long are to be found in *Yale Medicine* 1, 12, 1966; *Yale J. Biol. Med.* 41, 95, 1968; *Year Book of the American Philosophical Society*, 1970, p. 143; *Endocrinology* 88, 537, 1971; and *Nature* 229, 356, 1971.

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KEY TO ABBREVIATIONS

- Am. J. Med. Sci. = American Journal of the Medical Sciences
 Am. J. Physiol. = American Journal of Physiology
 Ann. Intern. Med. = Annals of Internal Medicine
 Ann. N.Y. Acad. Sci. = Annals of the New York Academy of Science
 Ann. Rev. Physiol. = Annual Review of Physiology
 Biochem. J. = Biochemical Journal
 Can. J. Biochem. = Canadian Journal of Biochemistry
 Cold Spring Harbor Symp. Quant. Biol. = Cold Spring Harbor Symposium
 on Quantitative Biology
 Ergeb. Physiol. = Ergebnisse der Physiologie
 Fed. Proc. = Federation Proceedings
 Jap. J. Physiol. = Japanese Journal of Physiology
 J. Biol. Chem. = Journal of Biological Chemistry
 J. Endocrinol. = Journal of Endocrinology
 J. Exp. Med. = Journal of Experimental Medicine
 J. Physiol. (Lond.) = Journal of Physiology (London)
 Proc. Assoc. Res. Nerv. Ment. Dis. = Proceedings of the Association for
 Research in Nervous and Mental Disease
 Proc. ——— Congr. Int. Diabetes Fed. = Proceedings of the ——— Con-
 gress of the International Diabetes Federation
 Proc. ——— Int. Congr. Endocrinol. = Proceedings of the ——— Inter-
 national Congress on Endocrinology
 Proc. ——— Int. Congr. Physiol. = Proceedings of the ——— International
 Congress of Physiology
 Proc. ——— Meet. Endocr. Soc. = Proceedings of the ——— Meeting of
 the Endocrine Society
 Proc. R. Soc. (Lond.), Ser. B = Proceedings of the Royal Society (London):
 Biological Sciences
 Proc. Soc. Exp. Biol. Med. = Proceedings of the Society for Experimental
 Biology and Medicine
 Recent Prog. Horm. Res. = Recent Progress in Hormone Research
 Yale J. Biol. Med. = Yale Journal of Biology and Medicine

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