

fibres and central connexions is gradually transformed into a living organization responsible for the most elaborate behaviour of the individual. His book is the more compelling because Sherrington's singular genius is stamped on every page of it—his tricks of prose, his epigrammatic constructions and his pregnant imagery. He has so much to tell us that he cannot be read lightly, but there is no book on physiology which is so well worth reading.

To all but physiologists his fame will rest more on the Gifford Lectures, "Man on his Nature", written more than thirty years later, when he had retired from the chair at Oxford with every distinction which a scientist can gain. This book, with its general theme, gives more scope for his wide learning and tolerant humanity. It is a worthy memorial to his many-sided understanding of Nature.

His scientific work is, of course, his greatest achievement. He discovered the sensory apparatus of the muscles, he worked out the detail and the general plan of the hind limb reflexes, he showed that the inhibition of the muscles which oppose a movement is as important as the excitation of those that promote it, he analysed the features which distinguish conduction in the reflex arc from conduction in the nerve fibre, giving a picture of the spinal mechanism in terms of neurones and synapses which remains the basis of all current research. His work continued long after the publication of the "Integrative Action" and was constantly justifying the principles he had laid down. His laboratory at Oxford became the leading centre for research on the central nervous system: the list of his collaborators includes the most distinguished names in neurological research, and there was never a time when it could be said that new techniques and new ideas had left him behind.

In fact, Sherrington's understanding of Nature was based on first-hand inquiry, on fifty years of hard work in the laboratory, on acute observation and astonishing technical skill. But although he had to contend with the distractions of administration and high scientific office he never lost sight of the wood for the trees. Even in his most technical discussion he would startle us by a vivid pictorial analogy with a hint of wider horizons.

Without his poetry and philosophy Sherrington's scientific work would have lost much that made it so illuminating, and without his experience of scientific discovery his insight into the patterns of medieval thought could never have gone so deep. He could not have realized so clearly the problems which faced Fernel in the sixteenth century if he had not himself faced the problems of Nature and found a twentieth-century solution. But whatever he had written or discovered, he would have charmed his contemporaries and his juniors by his courtesy and genuine modesty and friendliness, as well as by the range of his ideas and his great stores of personal reminiscence.

His shorter poems reveal the qualities which made him so well loved. They will no doubt become the material for future dissertations in the literary schools, for they contain real treasures in a little room, furnished in a style no longer in fashion but made acceptable by the care which has gone to the furnishing. The same qualities of sympathetic understanding and the same powers of lively description stand out in his writings of people and events, his obituary notice of Ramón y Cajal or the letter published in *Nature* of February 21, 1948, p. 266, about his journey to Lewes in 1894 to give the newly

discovered antitoxin to a small boy desperately ill with diphtheria. Here he is writing less formally, and one has a vivid picture of Sherrington as he used to talk, to a charmed group of listeners in the Combination Room or later in the bedroom at Eastbourne, where so many came to draw encouragement from his wisdom and charity.

In his long life he had enlarged the bounds of natural knowledge and he had shown how our ideas of the natural world have come to their present shape. He was too honest and too humble to produce any solution of ultimate problems; but he had set us all an example of how to accept our life, and we have lost one who was admired for himself as well as for his science.

E. D. ADRIAN

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In speaking of his early days at Caius College, Sherrington once told me that Hering's idea of two fundamental opposite processes, anabolism and catabolism, held a strong position among his contemporaries. He gave the impression that this notion also had influenced his own thinking and experimentation, apart from stimulating a permanent interest in the physiology of vision. Not until very recently has it become fully appreciated how well Sherrington's own concepts of two truly antagonistic processes of central excitation and central inhibition have stood the test of time and become classical by the only applicable criterion, that of being alive, because they were founded on experimentation matured into far-reaching insight. To Sherrington, central excitation and inhibition were two active processes, both of which displayed similar properties with regard to spatial summation and facilitation, adding up algebraically on the motoneurone as if of opposite sign. Elaboration of these and a number of other sound and fundamental concepts in a very difficult field ranks as high among his many achievements as his three greatest experimental contributions, all of which were concerned with posture and locomotion: reciprocal innervation, the studies on muscle sense organs including their reflex effects, and decerebrate rigidity. His gift for discovery was never more beautifully displayed than when he proved the muscle spindle to be a sensory end-organ, discovered the complex reflexes from the muscle which govern locomotion and posture, and, finally, integrated all this new information into a structure of knowledge in which these reflexes, reciprocal innervation, decerebrate rigidity and several other facts of reflexology fell into their right places as pieces of one puzzle.

Sherrington was a great teacher, not *ex cathedra* because his mind was too intricate and held too many reservations to be at its best in pronouncement and simplification. His mind was always searching and wondering, approaching its subject from new angles. His gift as a teacher was that of genius: inspiration, shared generously in intercourse with the young. When perceiving genuine appreciation and sympathy, Sherrington allowed his vivid imagination free play and supported it by a wealth of information from his boundless stock of knowledge of facts, people and incidents collected from a life that had—or so it seemed—experienced everything from the beginning of the modern scientific age. The remarkable visual detail in everything he told engraved it upon one's memory while one was waiting for the amused chuckle and quick upward jerk of the head

that preceded the climax and showed what in each instance had caught his fancy.

He loved the French civilization and for this reason, among others, I want to refer to some words by Paul Valéry on how the instinct that keeps driving a man to complete a piece of sustained strenuous mental work is doomed to be antagonized by everything that is not of the spirit. But this resistance, he goes on to say, may bring into life unexpected resources of light and strength. Valéry wrote this of Descartes.

Those privileged to have lived within the radiation of Sherrington's orbit will always remember him as a man in whom the spirit, intellectually as well as emotionally, had explored all its boundaries and returned with unexpected resources of light and strength. Nothing human was alien to him.

RAGNAR GRANIT

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THE passing of Sir Charles Sherrington, so many years after the close of his professional labour, must bring to many men a deep sense of sadness.

I can write of it only in terms of our personal relationship. No future Christmas will bring the "remembrances" from him that my wife and I had come to count on. No trip to England can ever again include a pilgrimage to see Sir Charles. But we, who have lived so far from him in body, have never been far from him in mind and now we shall not be cut off from him in spirit.

It was not the example of Horsley or Cushing that led me into the surgery of the nervous system. It was the inspiration of Sherrington. He was, so it seemed to me from the first, a surgical physiologist, and I hoped then to become a physiological surgeon. As years passed his influence did not grow less but stronger. Indeed, it often happens now that, during a routine operation, when the human brain of a conscious patient lies exposed and happy chance makes possible some observation that should throw light on physiological mechanism, I often seem to feel him looking over my shoulder.

In undergraduate days at Oxford, I remember once that he came behind me as I was carrying out my first mammalian experiment. For a little time he watched and then I heard him draw in his breath quickly, in a way he had of doing before he spoke, "You probably know how to do that better than I," he said, "but I should have thought . . .". I flushed and turned to him, thinking, for a moment, that he intended ridicule by his reference to my non-existent knowledge. But I learned better, for he was, of all men I have known, at once the most modest and the most intellectually honest.

In later years it never seemed to occur to him, as it has to one of his defenders, that such conclusions as we could draw from man were at variance with his own thinking. Indeed, he was thrilled by new evidence, and on our visits to him at Eastbourne in his later years, he, who never lost his zest for life, would remark with sparkling eyes, "It must be great fun to have the 'physiological preparation' speak to you".

Following the period of hospital training, I returned to Sherrington for postgraduate study at a time that may well have been the happiest period of his life. It was following the First World War. His son, Carr, had returned safe from overseas and Lady Sherrington was at his side. There was time for work and relaxation, for hospitality and reflexion.

No laboratory walls could shut in his spirit. He was a poet at heart and a philosopher, as well as a physiologist. What Oxford meant to him in those days he expressed in verse:

"The night is fallen and still thou speakst to me,
What though with one voice sole, with accents many,
Tongued turret and tongued stream, tracked pasture, fenny
And cloister, spirit trod, and centuried tree".

Nature did speak to Sir Charles Sherrington in many tongues. Early in life he passed from laboratory observations to an understanding of the integrative action of the nervous system and, in the process, he founded a school of neurophysiology. In later years he continued to hear the voice and interpreted it, though she spoke to him in other accents.

WILDER PENFIELD

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Mr. W. S. Millard

ON March 24, W. S. Millard died at Tunbridge Wells in his eighty-fifth year. He was the seventh son of the Rev. J. H. Millard and was born at Huntingdon. In 1887 he went out to Bombay to join the firm of Phipson and Co., and eventually became a partner. The late Herbert Phipson was a remarkable man who, besides founding and carrying on a very successful wine business, was the mainstay of the Bombay Natural History Society, and for eighteen years was secretary and editor of the Society's *Journal*. In 1893 Millard became joint editor, and when Phipson left India he succeeded him as secretary and held both offices until he finally returned to Britain in 1921. During his period of office the membership of the Society was greatly increased and the *Journal* enlarged. It was always his aim to encourage naturalists in India to write popular articles to attract more members, which would enable the size of the *Journal* to be increased and give more room for important scientific papers; in this way he built it up to become the most important scientific periodical in the East.

Millard's name will always be connected with the Mammal Survey of India, Burma and Ceylon, of which he was not only the originator, but also upon him fell the burden of raising money to keep three to four collectors in the field. The Survey began early in 1912, and up to 1915 he had raised Rs. 85,000; when it came to an end in 1923 more than fifty thousand specimens had been collected. Several thousands of skins were presented to the British Museum (Natural History), which now has the finest series of specimens from India, Burma and Ceylon, and made available material for the volumes compiled by Sir John Ellerman and the late Mr. R. I. Pocock.

Millard was a very keen gardener, especially interested in flowering trees and shrubs, and, in conjunction with the late Father Blatter, published in 1927 "Some Beautiful Indian Trees". Through his efforts the gardens of Bombay have been enriched with many fine flowering trees—none more beautiful than *Cassia renigera*, which he introduced from Burma in 1902.

He married Sybil, daughter of the late James Mackinlay, of Edinburgh, and is survived by a son and daughter.

N. B. KINNEAR