question.' Instead of, as is usual in physiology, leaving that impasse unmentioned, it seemed better to draw attention to it by the experimental observations in this book's final chapter."

Conclusion

And so we deem it a rare privilege to hail the man whose intellectual integrity has never allowed him to accept as truth anything that he has not proved to his own satisfaction. To the most profound student of the nervous system the world has yet known, the mind of man remains still unexplained. There are some, however, who may take issue with Sherrington when he modestly insists that the problem remains where Aristotle left it more than two thousand years ago; for many feel that Sherrington himself has pointed the road that will one day lead us to that goal. Some lines from *Ulysses* seem not irrelevant:

Come, my friends,
'Tis not too late to seek a newer world.
Push off, and sitting well in order smite
The sounding furrows; for my purpose holds
To sail beyond the sunset, and the baths
Of all the western stars, until I die.
It may be that the gulfs will wash us down;
It may be we shall touch the Happy Isles,
And see the great Achilles, whom we knew.
Tho' much is taken, much abides; and tho'
We are not now that strength which in old days
Moved earth and heaven, that which we are,—
One equal temper of heroic hearts,
Made weak by time and fate, but strong in will
To strive, to seek, to find, and not to yield.

For a complete bibliography of Sherrington's writings see appendix to the new edition of *The Integrative Action of the Nervous System* (Cambridge University Press, 1947). A full bibliography is also to be found in Denny-Brown's *Selected Writings of Sir Charles Sherrington* (London, Hamish Hamilton, 1940).

SHERRINGTON—THE MAN

BY

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"Such old enchantment as a boy's
when life first whispers use of life
entranced me . . ."

The words are from Sherrington's own verses on Iffley Church, and they confess a spell which in his case has been so strong and lasting that it is almost impossible to believe that we are called on to celebrate the ninetieth birthday of a heart so young. The occasion indeed calls for celebration, but it is difficult for a friend to pay adequate tribute to so essentially living a man, and the task is made the harder by Sherrington's own unself-conscious modesty, which springs from his intense interest in the outside world but nevertheless makes him vulnerable to shafts of honest praise. But he belongs to the world, and not to himself.

Sherrington was born on November 27, 1857. After leaving his school at Ipswich he began his medical studies at Edinburgh, where he was happy, but whence he was soon transferred to Cambridge to be there with his brother. On entering Caius College, his real Alma Mater, in 1880, he took his full part in its life—intellectual, social, and physical. Although slight of build he was fast on his feet and wiry, and in spite of his lightness he played as a forward in the college XV—a fact which says much for his athletic quality. His short sight, which forced him to use glasses, prevented him from taking much part in other games, but later in life he climbed in the Alps until about the time of his marriage, and it is easy to understand how he has retained an interest in, and a sympathy with, athletic games and sports.

Early Influences

He was at this time greatly influenced by the men, such as Michael Foster and Gaskell, who were then playing their great parts in advancing the young British school of physiology and were bringing the spirit of experimental science into medical research and education as a whole. That spirit ultimately derived from the great experimenters of this country who had formed the Royal Society in the seventeenth century; but so far as medical science was concerned, the experimental method had flourished more vigorously in Germany during the period just before the Franco-Prussian War of 1870-1, when it had been brought back from Germany to its original home. In Sherrington's undergraduate days the heaven had so far chiefly affected physiology: anatomy remained a purely topographical study; pathology, not yet established as a chair at Cambridge, was largely a matter of the post-mortem room and the museum.

We may picture the young Sherrington as at first captured by the experimental spirit rather than by physiology as a special field for its adventure; but the picture will also show an unusually keen, inquiring, and zestful undergraduate who not only took a catholic interest in many subjects, but was also urged by his curiosity to learn what he could about the objects of his manifold interests. Above all, he projected himself, as it were, on the external world, and to that are due his absence of self-consciousness and, closely related thereto, the modesty, too unstudied to be shy, which is sometimes almost an embarrassment to his friends.

Towards the end of his time at Cambridge he was Demonstrator in Anatomy, and then, having taken Part II of the Natural Sciences Tripos with first-class honours, he went on to London in 1884 for his clinical studies at St. Thomas's Hospital. In that year also he held the George Henry Lewes studentship for physiological research at Cambridge, and his first scientific paper, a largely histological examination of the nervous system of one of Goltz's decorticated dogs, was written in collaboration with J. N. Langley. During the winter of 1884-5 Sherrington worked for a time in Goltz's Physiological Institute at Strasbourg, where C. S. Roy had held the post of assistant a few years before.

Experience Gained Abroad

In 1885 Sherrington obtained his membership of the Royal College of Surgeons, and in the same year he was sent by the Royal Society with C. S. Roy and J. J. Graham Brown to investigate the outbreak of Asiatic cholera in Spain, where these lifelong friends spent the summer and autumn. Of the three, Sherrington proved to be the best linguist, and to him fell the difficult and aggravating negotiations with the various officials who, properly, prevented access to the cordoned-off villages, but who could be induced with equal propriety, and by the traditional local method, to let the investigators pass. His mastery of the language led Sherrington to take an interest in Spanish literature, and particularly in the Spanish dramatists; and to it he also owed his friendship with Ramón y Cajal, who stayed with him in London some years later. The obituary notice of Cajal which Sherrington wrote for the Royal Society in 1935 is a tribute not only to that friendship but also to his own capacity for deep feeling. Not least among Sherrington's merits is his genius for solid and disinterested friendship.

After these pathological studies, and during the winter of 1885-6, Sherrington returned for a time to physiology at Cambridge, where Roy, who had been the first George Henry Lewes student in Sherrington's undergraduate days (1881), was now the newly appointed first Professor of Pathology. Later in 1886 Sherrington went to Italy to

investigate another outbreak of Asiatic cholera, and he thereafter spent more than twelve months in Germany, examining his pathological material in Virchow's laboratory and then more profitably with Koch, but also working in Berlin at experimental physiology with Zuntz and at histology with Waldeyer. On returning home in 1887 he became Lecturer in Physiology at St. Thomas's Hospital, his first independent post. In later years he worked again with Goltz in Strasbourg, and for a short time with Pfleger in Bonn, and elsewhere.

This foreign experience was a strong factor in Sherrington's subsequent development and in his general attitude to academic study. The great German masters of these days had been bred in the traditions of the idealistic, almost pastoral, Germany which existed before the beginnings of industrialization and materialism that followed closely on the Franco-Prussian War and on the creation of the German Empire of the Hohenzollerns. In that older Germany, which persisted in the strongholds of the universities, the ideal of academic liberty and the belief in the obligations as well as in the dignity of the academic life were felt to require open expression and assertion if they, and what they stood for, were to be maintained intact and handed on from master to pupil.

In that atmosphere loyalty was given above all to the objects for which an Institution was the instrument rather than to the Institution as such, and nowhere was this spirit stronger than in Strasbourg. Sherrington had been captured by the missionary spirit of his teachers at Cambridge. At Strasbourg, his first foreign experience, he again met it. When the Prussian Government refounded that university soon after the annexation of Alsace as a spoil of the Franco-Prussian War, the new chairs were offered to the best men in Germany, who regarded it as a point of honour not to refuse the call. The missionary spirit which moved that brilliant group of men was further strengthened by the local atmosphere which prevented social contacts between Germans and Alsations and, even up to the time of the first world war, made it impossible for the two to drink their midday coffee at the same restaurant on the Kleberplatz. The isolated Germans could not have failed to feel, as in fact they did feel, that they held their chairs in *partibus infidelium*, and, as a necessary effect, their strong academic idealism seemed to call more than ever for conscious expression, almost fanatical.

The beginnings of the anti-vivisection crusade had already caused something of the same sort to happen at home, and to the impact of these missionary atmospheres may perhaps be ascribed Sherrington's strong views about academic liberty and intellectual honesty, his clear vision of the objective beyond its instrument, his belief in the fearless but judicious expression of opinion, his hatred of academic or political expediences, and his distrust of what he calls "institutionalism"—the concentration of personal loyalty on the corporation rather than on the end for which it is devised. His rare anger is roused by sins against his own high ideal, and by little else except unworthy conduct, or meanness, or (as a passing flash) the culpable ineptitude of some unfortunate assistant. He taught one that in all things only the best is good enough, but he could sympathize even with our shortcomings.

His Contributions to Knowledge

Sherrington became professor-superintendent of the Brown Institution in 1891, and his marriage in 1892 began a continuously happy partnership with the lady to whose kindness we all owed so much. During the four years of his work at the Brown Institution before he succeeded Gotch as Professor of Physiology at Liverpool in 1895, Sherrington's scientific interest definitely turned to the

subject which became his life's work. Before 1891 the greater number of his contributions to knowledge had been concerned with the structure of the nervous system; thereafter, the localization of function, as in the spinal roots, attracted him; and his interest in the clinically significant knee-jerk led him finally to the study of reflex function itself, as is described elsewhere by the able pen of Professor Fulton. Here again he gave his loyalty to the end rather than to the instrument—to function rather than to structure—and the parallel is revealing.

As a lecturer Sherrington had defects due to his own scrupulous search for exactness and clarity. He would pause, seeking the only word or phrase which would convey his precise meaning, and his dislike of dogmatic assertion caused him to insert qualifications and corrections as if in brackets. This would lead to hesitations and complexities, and it gave the impression that his own thought was being created and moulded as he went along. The ordinary student, fresh from the unequivocal teaching of the anatomy class, disliked the mental effort of learning which Sherrington's lectures demanded; but to those who wished to learn the effort was itself educative, and both the matter and the manner were fascinating. Similarly, his published work at first appealed to a limited circle, although within that circle the appeal was strong; and this was perhaps to be expected where a new terminology had to be invented in what was to all intents and purposes a new field, where the subject itself was of great complexity, and where the results might strike the unthinking as purely "academic"—that is, as of little practical significance. Even the importance of Sherrington's *Integrative Action of the Nervous System*, which was published in 1906 and is now recognized to be a landmark in physiology, was realized somewhat slowly by the generality.

His Varied Interests

It was to those who worked in his laboratory that Sherrington gave most and showed most. The research student would enter it, timidly, with a mental picture of the author of *Integrative Action* as a man who must dwell in a sphere of his own making, difficult to attain or to travel in—a man necessarily aloof and out of common reach, "academic," coldly intellectual. But the disarming spirit of equality with which the recruit was received at once destroyed a mental barrier which could not in any case have for long withstood the sympathetic friendship which was offered by Sherrington and earned lasting friendship in return. There was no pomp, no vestige of that Olympian arrogance which was so evident in some of the larger German institutes of the time. The laboratory life was a continuing adventure with always widening horizons. Chance talk would reveal what (but only at first) seemed to be Sherrington's surprising interests outside his own sphere—the Roman Wall, the Dutch masters of painting, Gothic architecture, old books and out-of-the-way bypaths of literature, the history of mechanical inventions, poetry (with strong preferences—Keats for one, and Tennyson, when the latter was still under a cloud in Bloomsbury), the Darwinian theory of evolution, the aesthetic movement of the 1880's, Canada, and all things youthful and adventurous. These in their turn would disclose unsuspected capacities for feeling and depths of feeling, as did Sherrington's own occasional verses. It was indeed possible, without self-consciousness, to show one's own verses to Sherrington—a thing which speaks for itself. In his emotions, too, Sherrington was catholic, and he would be moved not only by the beauty in a picture, or in an act, or in a mountain scene, but also by the beauty of an experiment or of an ingenious technical method. And always there was originality and insight. What would

delight the pupil was less the width of Sherrington's interests than the depth of his knowledge in each; and by the time the pupil had replaced his first crude picture with that of a many-sided, a lovable, and a very human man he himself had received a liberal education.

In such matters Sherrington for long kept himself to his intimate circle of friends except for the rare event of such verses as those in which he wrote of Canada in 1911, and the later poems to which he was moved by the first world war. It is true that he published some of these in *The Assaying of Brabantius* in 1925, but it was not until after he had retired from the chair of physiology at Oxford in 1935 that he really began to give the ordinary cultured reader what he had given to his happy laboratory or at his own fireside. Three articles in the *Cornhill Magazine* of 1936 and 1937 may be instanced here, as also his penetrating essay on *Goethe* (1942) and some remarkable reviews such as that in *Nature* (1937) on Ramón y Cajal's *Recollections*. But amongst all the works of these recent years there stand out his two memorable books—*Man on His Nature* (the Gifford Lectures given at Edinburgh in 1937-8 and published in 1940) and *The Endeavour of Jean Fernel*, which appeared only last year. When we reflect that these multifarious activities are the work of a man in his ninth decade and sadly hindered by arthritis, we can only marvel at the persisting strength of the enchantment cast by Sherrington's youthful spell. And now, because it is the privilege of the recipient to ask for more, we may send our greetings and our thanks to Sherrington with fervent hope that he will long be preserved to add to the debt which we already owe him, and to continue what he himself expressed in *Brabantius*:

"Impulsion stirred me, resolute
with heart a-search and hastened foot,
to work men service. . . ."

SHERRINGTON AS PHILOSOPHER

BY

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It should be the task of the philosopher to review critically the thought of his day, taking the various specialist modes of approach in a wider setting than is needed for a purely specialist treatment and trying to attain to a more comprehensive or synoptic view. There is an aspect of this task which is often forgotten and seldom rated as highly as it deserves. That is the interpretation of the thought of the past so as to make it intelligible to the present. In scientific subjects it is easy to get a distorted perspective unless we understand how recent thought has grown out of the earlier stages through the efforts of the pioneers, who nearly always mingled acute insight with confusion.

Because this work of interpretation is generally underrated I mention first Sir Charles Sherrington's exposition of the ideas of Jean Fernel in *Man on His Nature* and in his more recent book *The Endeavour of Jean Fernel*. In the fifteenth century, though Vesalius and Copernicus were at work; no branch of science except mathematics had yet reached a firm basis. Medicine was still weighed down by misunderstood tradition, bogus information, and downright superstition, astrology specially. Though scientific medicine belonged to the future, Fernel was struggling towards the light in a most interesting and suggestive way. To interpret that struggle requires sympathetic insight, a firm grasp of principle, and much hard work to see what lies behind confused and archaic terminology and to reconstruct

forgotten ideas. The book on Fernel is a masterpiece, and—that very rare combination—a book that is a pleasure to read and also a work of scholarship in the strictest and most academic sense. In his lecture *Goethe on Nature and Science* Sir Charles shows the same skill in interpretation. Of course the reason for his skill is not far to seek. The author is both a poet and a man of science.

His Gifford Lectures

However, the philosophy of Sir Charles will always be judged by *Man on His Nature*, in which he took the opportunity afforded by the Gifford Lectures to survey the relations of the material, the living, and the conscious as displayed in the functioning living organism in general, and more especially in the functions of the nervous system. He also considered the place of mind or conscious life in the universe as a whole. The modern sciences of physics and chemistry, he argued, have expanded and sharpened our conceptions of material things so that the old simple-minded view that life is a kind of fire, which passed muster in the days of Fernel, is now dropped except as a metaphor, apt in one respect but misleading in all others. If greater knowledge of the material world has sharpened certain distinctions and abolished old fallacies it has not solved the main problem of the relation of the material and the mental; indeed, it has raised new problems. The physics and chemistry of the living body are peculiar and complex, but still physics and chemistry.

In the purely material realm things and processes, though in some respects continuous, are in other respects "granular," wrapped in bundles all separate and all similar—the quantum of action, the electron, the atom, the molecule. In the organic realm there are also "granular" entities on a larger scale that are fundamental—the gene, the nervous impulse, the cell. There is in addition a process of co-ordination or integration at work, operating through purely physical and chemical means, yet exemplifying an order over and beyond the physical order. In spite of this integration, the most elaborately integrated of all organisms, the human, though possessing a master organ, the brain, possesses no master cell. Instead, the highest centres of the brain appear to be a kind of republic of millions of cells. Where does the mind come in? Mind is certainly not granular in the way that atoms and nervous impulses are. It is not a special kind of matter or of energy, as earlier speculators often suggested.

The bodily organism which contains millions of cells can do a number of things simultaneously by means of reflexes and acquired habits, but the mind attends to one thing at a time. It goes so far as to see one visual field through the medium of two distinct organs. Moreover, for a great deal of psychology knowledge of brain function is irrelevant. This is seen equally in the modern work of the psycho-analytic school and the many excellent psychological observations of Aristotle, who associated the heart, not the brain, with conscious life.

Association of Mental Process and Bodily Functioning

In all this discussion Sir Charles brings out clearly the close association of mental process and bodily functioning and at the same time the difficulty, if not the impossibility, of completely identifying the mental with any kind of structure or activity of the body. Aristotle in his own way seems to have felt the same difficulty. He conceived of a hierarchy of bodily activities, the higher developing out of, dependent on, and yet fulfilling the lower. Sometimes he seems to identify the highest bodily activity with mental activity and sometimes to consider mind as distinct and perhaps even separable, following Plato to that extent. Sir Charles's conclusion is that man is really part of the