SHERRINGTON—A LINK BETWEEN TWO CENTURIES

by

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SIR CHARLES SHERRINGTON'S pre-eminence as a neurophysiologist was manifest during his lifetime by the honours bestowed upon him: a knighthood, the Order of Merit, and the Nobel Prize. The effect of his *Integrative Action of the Nervous System* on a receptive member of the generation maturing in the first decade of this century has been vividly described by Sir Francis Walshe:[1] 'I can yet recall the feeling of exaltation with which . . . I first read his *Integrative Action*. Here were new facts of observation in rich abundance, and how beautifully co-ordinated! With what logical precision the exposition of them advanced from step to step, and with what penetrating scientific imagination was their significance revealed!' More recently his researches on the nervous system have been outlined by Lord Cohen[2] and discussed against their historical background by E. G. T. Liddell.[3] The bibliography appended to the selection of Sherrington's papers edited by Denny-Brown[4] is indicative of the great physiologist's interests which ranged far outside the subject which earned him fame. A perusal of his non-technical writings is doubly rewarding, illuminating for us, as it does, the scientist's character and recreating the times through which he lived: during Sherrington's life span both Lister and Alexander Fleming saw their work bear fruit, Brown-Séquard injected himself with the aqueous extract of ground-up testicles, and Kendall isolated Compound E.

Charles Sherrington the son of Dr. James Norton Sherrington of Yarmouth was born in London in 1857. His mother re-married after Dr. Sherrington's death and the boy had his early education in Ipswich where Dr. Caleb Rose, his step-father, resided. A school may be defined as an establishment for the tuition of children but according to Sherrington,[5] 'We may, if we look into our own minds define it with greater aptness as par excellence the place of growth —figuratively, a garden set apart and tended for the protection and the encouragement and the supervision of the growth of the young body and the young mind.'

During school-days the boy grows almost to adult stature and Sherrington pointed out:

> This period is therefore fraught with vivid interest to the parent and the community that has proper interest in its own efficiency of the immediate future. And this period of development is entrusted chiefly to school régime. For the school, therefore, a duty paramount is to see that no block or bar cramps the springs of growth, and that the young life given to its charge can at least flower to the fullest that its ancestral heritage of natural power allows. This is a sacred duty of the school.

These reflections were of his maturity. Less serious, doubtless, the thoughts of his own schooldays and we know that apart from intellectual prowess he

displayed more than average ability as a footballer at Ipswich Grammar School and later at Cambridge University to which he went after spending a short period at Edinburgh.

At Gonville and Caius College when Sherrington was an undergraduate the Master was Dr. Norman Ferrers, 'whom we saw but little'. In the medical school the great Triumvirate in the early 1880's of the last century were Michael Foster, George Humphry, and George Paget—a brother of the better-remembered Sir James Paget—but for Sherrington 'an even more appealing triumvirate in that then small and ramshackle haunt of Physiology were Gaskell, Langley, and Lea'.[6]

Walter Gaskell was then laying the foundations of present-day knowledge of heart-block, his work deriving from that of G. J. Romanes, a Canadian who had built a private laboratory for marine biology at Dunskaith, on Cromarty Firth and whom Sherrington described as[7]

> an ardent biologist of fine mental gifts and of philosophical turn and training. The work he engaged on at Cromarty Firth was a study of the contractile movement of the swimming-bell of Medusa. His observations carried out with simple means were novel and fundamental. The questions which he put to the swimming-bell and answered from it, led, it is not too much to say, to the development of modern cardiology. Medusa swims by the beat of its bell, and Romanes examining it discovered there and analysed the two phenomena now recognised the world-over in the physiology of the heart, and there spoken of as the 'pace-maker' and 'conduction-block'.

Romanes' work, published in the *Philosophical Transactions* of 1877, had directly inspired Gaskell's on the heart, this latter proving in its turn and in due course a stepping-stone to James Mackenzie and to Sir Thomas Lewis. From St. Andrews to Dunskaith is not so far; and it may well be that had time not sundered them James Mackenzie and George Romanes would each have made a pilgrimage the one to the other; what a meeting!

John Newport Langley, five years younger than Gaskell, was closer in years to Sherrington and probably a major influence on him:[8]

> To work under him or with him was to see exemplified a fidelity of observation, a detachment from pre-conception, and an untiring search for new facts which formed at once a lesson in character and an inspiration in method. . . . His gift of minute observation was such that in his hands simple inspection was often as reliable as graphic registration by recording instruments. He was always on his guard against deception by technique.

When Sherrington first encountered him Langley was studying the effect of pilocarpine on the salivary glands.[9] 'He found that the new drug exerted a specific influence on the secretory process. He took this reaction as the point of departure for a study of secretion in general; he followed it with a precision which had never before been approached. . . .'

Later Langley investigated the sympathetic nervous system and Sherrington called his work 'a landmark in the history of physiology'. 'Indeed, the functional anatomy of a portion of the nervous system, knowledge of which had previously been a sheer confusion of obscurities, and mistakes, he left perhaps the most clearly elucidated in the body. . . .'

Young Sherrington found the camaraderie of Cambridge laboratory life 'something unforgettable'; at St. Thomas's Hospital in London his work among the poor who thronged the out-patient clinics, by contrast, was 'an experience startling and ineffacable'. He may have mitigated his disturbed feelings by reflections on the antiquity of the institution he served—an awareness of history pervades his writings—for in its former site 'It stood opposite Southwark Cathedral, and with Chaucer had seen pilgrims set out for Canterbury from the Tabard Inn near by. Richard Mead, Dr. Johnson's 'Maecenas', was one of its physicians. . . .'

And besides, nobility could be glimpsed beneath the tattered garments of the poor to whom he ministered. He attended his first midwifery case in a basement cellar crowded with humanity led there through dark streets by the husband who hovered close by through the ensuing hours.[6]

Before daybreak I prepared to leave. To my astonishment the young husband proposed to see me home—there was no gainsaying him. He insisted on carrying my bag all the way. Back at the Hospital we parted with a handshake, and I could have cried 'Concitoyen', I admired him so.

Awaking late next morning Sherrington found the room he shared with another already noisy with the clamour of poker-playing students. 'The trivial vulgarity of the scene I woke to contrasted dreadfully with the dignity of the poverty I had glimpsed hardly half a mile distant up the road.'

Such sensitivity might have set him apart from his class-mates but the natural modesty which characterised him throughout his life would have maintained a balance. After qualifying, however, he did not like most of them embark at once on clinical work; instead, with C. S. Roy and J. Graham-Brown, commissioned by the Association for the Promotion for Research in Medicine to investigate the relation between Koch's comma bacillus and Asiatic Cholera, in the summer of 1885 he went to Spain where there was an epidemic of the disease.

Charles Smart Roy, Sherrington's senior by a few years and leader of the expedition was a native of Arbroath, an Edinburgh graduate and a former pupil of Michael Foster. He had lately relinquished the superintendentship of the Brown Institution where he had done research in pleuro-pneumonia in cattle. 'His interest in biology was strikingly catholic,' Sherrington wrote,[10] 'but problems dealing with the circulation had paramount interest for him.' He was a man of great physical courage

amounting to enjoyment of personal danger. Among his pastimes were boating and riding. The flight of birds, the possibility of aerial flight by man, and the construction of flying machines formed a favourite theme of conversation with him; and he had made some experiments on the subject.

The conclusions reached in their report to the Royal Society[11] were that the comma bacillus was pathogenic and had some relation to the disease but its complete absence in many cases made it impossible for them to accept Koch's view on its causal relation to Asiatic Cholera. In all of their twenty-five autopsy

specimens they claimed to have observed filaments and granules of a vegetal parasite with the characteristics of *Chrytridiaceae*. 'Further investigation must decide whether or not it can be looked upon as the direct cause of the disease.'

In 1887 Michael Foster communicated a note by Sherrington to the Royal Society. 'Last Summer when Cholera again appeared in Italy I determined to seize the opportunity that seemed to offer itself for re-examining the disease, especially with regard to some questions raised by the work of the previous year.'[12]

He had 'failed after minute, long and repeated search' to find any trace of the appearance they had noted in the previous series. He found the comma-shaped bacillus in thirteen out of twenty-two cases and thought that 'a still more extended series of preparations' would have made the incidence higher.

From Italy he had taken the material collected in Puglia to Berlin, to the laboratory of Rudolf Virchow, founder of cellular pathology. But Virchow, then a member of the Reichstag, was embroiled in politics; Sherrington was taken to hear Bismarck speak and after two months was advised to work with Robert Koch, discoverer of the causative organisms of anthrax, tuberculosis, and cholera. He took the customary preliminary course in technique and remained for nearly a year in Koch's Institute although not unduly impressed by the depth of Koch's thinking. 'There was I fancy at that date very little chemistry in his pathology.' During the time he was with Koch he attended Waldeyer's histology lectures. He also worked with Zuntz, a respiratory physiologist. On a previous visit to the Continent he had studied under Friedrich Goltz at Strasbourg and spent a short time with Pflüger in Bonn.

On his return to England in 1887 he was appointed lecturer in physiology at St. Thomas's and in this year he met Edward Sharpey-Schafer.[7]

> Strange to say I cannot now recall the exact occasion. There was about him no affectation. He was the sort of colleague whom one quickly got to know. . . . When I recall him as he was then, I see a spare figure the reverse of robust in appearance, and pale, for he had not then that complexion tinted with healthy wind and weather which Edinburgh and North Berwick gave him in later life. But although he did not look strong his energy was tireless.

Another rising physiologist, a Guy's man, whose friendship he gained at about this time was Ernest Henry Starling whom we remember best today for his 'law of the heart'.[13]

> One of my earlier personal recollections of Starling goes back to a time when we both of us were teaching physiology in London, and on the arrival of the summer vacation took our holiday together climbing in Switzerland. His enthusiasm for the hills and mountains was immense. He was a good 'goer'; he made one of the most excellent and enjoyable of companions.

Senior to these young men in years and attainments was David Ferrier whose scientific achievements Sherrington thus outlined:[14]

> It was early in 1873, after a visit to his friend and fellow graduate Dr. (afterwards Sir) James Crichton-Browne, at the West Riding Asylum, Wakefield, of which Browne was then director that Ferrier began his memorable researches on electrical excitation of the brain. This work

continued at King's College, he prosecuted steadily by his method of faradic stimulation until the brain had been explored systematically in a series of vertebrate types up to and inclusive of the monkey. Ferrier's observations gave to the hitherto disputed existence of 'localisation' of cerebral functions a solid basis of proved experimental fact. . . . Ferrier, from the experience of his work on monkeys, drew the further inference that, with Listerian precautions against sepsis . . . conditions of disease in the brain could be effectively dealt with surgically to an extent not hitherto attempted. . . . Sir Charles Ballance, himself distinguished in brain-surgery and versed in the history of its development, has said with characteristic penetration and generosity that to Ferrier no less than to the surgeons themselves the origination of modern cerebral surgery is primarily due.

Sherrington also remembered[15]

The interest and pleasure afforded to a foreign visitor, Señor Cajal, the histologist by finding Ferrier in the laboratory, experimenting; and the impression made by the simple hearty welcome and the frank comradeship which delighted in continuing the experiment and in showing and explaining each step to the younger colleague from abroad.

Santiago Ramon y Cajal then visiting London was staying with Sherrington who has given us a graphic picture of the Spaniard.[16]

Cajal was short in stature, wide of shoulder and long of arm, this latter showing the more because his gait tended to stoop. His olive-complexioned and large featured face was melancholy in repose. But in repose it rarely was; whether speaking or not he had an intensity of expression to which variety was lent chiefly by the remarkable eyes. Full and dark, they lit or gloomed according to each passing mood.

Cajal established the neurone as the anatomical unit of the nervous system and for him this carried obvious functional implications.

The grey matter seemed to be, therefore, perfectly determinate in its sense of conduction. The points of contact discoverable in it seemed to him specific places of articulation between one cell-conductor and the next. The direction of conduction in these chains could, moreover, be read by noting certain features repeating themselves from cell to cell. So it was that he reached his generalization; in every nerve cell the conduction runs from fibres of cellulipetal conduction toward a fibre of cellulifugal conduction, usually through the intervening cell-body; this is his 'ley del la polarizacion dinamica de la cellula nerviosa'; a discovery, which, for historical importance, ranks with the Bell-Magendie 'law' of the spinal roots; but it is, of course, far wider and more fundamental.

Summing up Cajal's studies on the nervous system Sherrington wrote:[17]

It is probably true to say that no single observer yet so enlarged our knowledge of the construction of that system. His fresh conception of the structure carried with it unusually unequivocal inferences regarding certain fundamental features of its working. For physiologist and pathologist the nervous system after Cajal's discoveries and interpretation was something so much clearer and so other than it had been as to be a system almost new, and one immensely more intelligible.

Sir Michael Foster continued to be an influence on him and Sherrington wrote:[18]

It seems almost a commonplace truism to say of his attitude toward medicine that he was an enthusiastic observer of all progress, for his range and depth of interest in all biology was

extraordinarily wide and keen. He took genuine interest in younger men and their work, and he rejoiced in their scientific achievements often with an almost paternal delight. One of his eminent gifts was, it has seemed to me, a personality that fascinated by a native dignity free from any tinge of affectation or ostentation. His nature was brimful of kindliness. Those who knew him well found in him a so-to-say Shakesperian catholicity of touch and sympathy with and charity toward, people of every description.

A brief comment concerning Sir John Burdon-Sanderson, Regius Professor of Medicine at Oxford:[19] 'I carry away the impression from acquaintance with him in his later years that he regarded medicine as an experimental science'—brings us to an important phase of Sherrington's career, for Burdon-Sanderson was first of a distinguished line of Professor-Superintendents of the Brown Institution where Sherrington became Professor in 1891.

The Brown Institution increased his scope for experimental work on animals and like other physiologists at that time he was keenly aware of the difficulties, not to say dangers, of his position *vis à vis* the militant anti-vivisectionists. It was this awareness that led to his polemic with Lawson Tait of whom Canon Wilberforce had said: 'We feel towards him a sort of hero-worship and sympathy. He is the *Athanasius contra Mundum* in the great battle against vivisection', and who had himself said: 'I regret that I have to offer to the British public an apology on behalf of my profession and I do so with a sense of degradation which I cannot find words to express'.

In a letter to the *British Medical Journal* dated 15 November 1892 disagreeing with certain remarks made by Samuel Gee in his Bradshaw lecture, Tait asserted that 'the slightest touch . . . applied to almost any part of the peritoneum . . . gives rise to movements . . . which indicate pain'.

Sherrington contradicted him in the *Lancet*:[20] 'The peritoneum was shown by Haller in the experiments of his famous essay to be quite insensitive to mechanical and many other modes of excitation . . .' and suggested that Tait was unacquainted with Haller's work, an example of the fruits of vivisection which the Birmingham surgeon affected to despise.

Early in 1894 Sherrington published a note describing the results of cerebral ablation experiments carried out by him on monkeys at the Brown Institution.[21] In the following issue of the *Lancet* a letter from Victor Horsley stated that the research in question, duplicated at University College by his assistant, had been undertaken by Sherrington on Horsley's suggestion but later abandoned. He hinted that Sherrington had acted unfairly in returning to it and the tone of his letter annoyed the physiologist who in his reply remarked that he would not 'admit for one moment that Professor Horsley has any exclusive right to the research'. Horsley demanded that arbitrators from the Research Club should consider the matter but Sherrington, possibly regarding it as a storm in a teacup, refused to co-operate. An acid letter from Professor Boyce, who was working with Horsley at the time, concluded the correspondence.

One feels that any imputation of acting dishonourably would have upset Sherrington considerably. Furthermore the tone of Horsley's first letter ('I detailed the plan of the investigation . . .') must have stung him. They were exact contemporaries and although Horsley's brilliant neurosurgical operations

had carried him further along the path to fame it is unlikely that his flair for physiological experiment equalled Sherrington's. An outcome, according to the late Professor Fulton, was his suppression of further relevant publications until after Horsley's death at Amarah in 1916. Whatever feelings were stirred by Boyce's outspoken letter were resolved and later they were close colleagues in Liverpool.

Meanwhile he witnessed an epochal event; a demonstration of the action of adrenaline.[7]

Saturday, 10th March 1894, was a day of note for medicine and physiology. On the afternoon of that day George Oliver and Edward Schafer demonstrated in the latter's laboratory to their fellow-members of the Physiological Society of that time the action of intravenous injection of a small dose of watery extract of the suprarenal capsule. I remember well, for I was among those present, the profound impression the demonstration made on the little meeting. It opened a scientific vista, a vista which increased for each of us as conversation proceeded. I doubt, however, whether any of us foresaw, even so, one tithe of the full harvest of knowledge which was to ripen and be garnered from that experiment. . . . I do not think that any of us, even seeing it, foresaw what, as we look back, seems now a self-evident inference, that that experiment would largely transform the physiology that was coming into a chemical science, a science whose transcendent interest lay in biochemistry. That experiment, as it were, epitomised internal secretion, and the acute activity of a ductless gland. It rehabilitated humoral medicine—it was in a way, if I may coin such a word, a reapotheosis of Galenical theory. Where Paracelsus had tried and failed, it triumphed and without quackery.

Sherrington went to Liverpool as Holt Professor of Physiology in 1895, an appointment that made him more than ever aware of his responsibilities as a teacher.[22]

No single individual can fitly in my opinion, teach such extensive and rapidly-growing branches of natural knowledge as animal physiology and animal histology. For the exposition of a science to really reach its hearers the presentment of it must be living and authoritative. The ability to make such a presentment can only be obtained from practical acquaintance with the inquiries into its problems. . . . Any conscientious teacher entrusted with the whole range of physiology proper has no light task to keep abreast with his theme in all its width of chemical, physical, and psychological inquiry. The teaching of histology has similarly an influx of new facts and rapidly-changing technique to take account of. Considering the teacher merely in his *rôle* of lecturer, instructive lectures of a kind have undoubtedly been given by men of ability, the whole of whose knowledge of a lecture subject was secondhand, but it is more than doubtful whether the real life of any science can be felt, still less communicated, by one who has not himself learnt it by direct inquiry from Nature.

His 'Demonstrator' was Albert Sidney Leyton who 'combined in rare measure enthusiasm for research with a critical, and, indeed, highly self-critical attitude of mind. . . . The advance of practical medicine was with him a passion'.[23] Leyton, while working in Vienna, devised a diagnostic agglutination test for typhoid but delayed reporting the discovery until he had twenty cases, consequently suffering the ill-fortune of losing priority (and eponymous fame) to Widal whose paper based on *two* cases appeared in the *Presse Médicale* a few weeks before Leyton's paper was published.

Rupert Boyce, a Londoner of Irish parentage, had preceded Sherrington to Liverpool where he held a chair of pathology.[24]

He threw himself at once into the task of organizing a laboratory of scientific pathology. . . . His laboratory quickly became a centre for workers attracted by and sharing his enthusiasm. Much valuable research issued from it. Greatly though his laboratory absorbed him and flourished, problems concerning the Univerity College as a whole began to occupy his mind even as much or more. . . . In his view the College was *de facto* a University; he also realized that an immensely increased sphere for public preventive medicine was at hand. He urged it as the duty of, and opportunity for, the College to take up vigorously forthwith the teaching of hygiene, technically, practically, and yet scientifically, to all in the community, entering on its practice, even in its humbler aspects—sanitary inspectors, builders and plumbers. To the academic body this did not greatly appeal; its apathy chilled Boyce little.

His efforts resulted in the foundation of the School of Hygiene, and Sherrington said of his achievement: 'It revealed his boldness and shrewdness to appeal for University aims to a non-University public, and his ideal of a University life dovetailed by public utility into the life of a civic community'.

When Mr. Chamberlain, then Colonial Secretary, wrote to the Faculty of Medicine at Liverpool urging the establishment of a department for the study of tropical diseases his suggestion was by some regarded as 'a rather presumptuous piece of official interference. . . . But Boyce's mind caught fire. . . . He would do it himself if the Faculty would not.' He interested Sir Alfred Jones in the project: 'By them in conjunction was founded the Liverpool School of Tropical Medicine.' Major Ronald Ross, discoverer of the mosquito-borne nature of malaria, then on his way home from India, was appointed Director.

Sherrington's close association with these developments in Liverpool would have forced him to ponder deeply and often on the duties of the University towards the Community. He saw the pursuit of science as a civic duty and truth as something to be sought for its own sake.[25]

Scientific truth when found, has often proved unpalatable to man—as when it dethroned him from his fancied seat at the centre of the whole perceptible universe, a universe he had imagined simply subservient to his needs; or again, as when it taught him that instead of being a creature altogether apart from brute creation there are flesh and blood bonds between himself and them. Regardless of its cost to his cherished fancies man strives for scientific truth. And, as the old Greek said, this purpose puts him further from the brutes and nearer to the gods.

And research, he pointed out, should not be obliged to promise an early fruitful outcome.

Our nation, proud of its success in things practical, has been prone to despise the abstract and the theoretical. We do so foolishly; we do so at our peril. Behind all practical application there is a region of intellectual action to which, though our practical men have contributed little, they owe the whole of their supplies. Theory, if a goose, is the goose of the fairy tale that lays the golden eggs. No more such eggs if once you let her die.

Sir Rupert Boyce died in 1911. Two years later Sherrington was invited to the Wayneflete Chair of Physiology in Oxford University where at that time Sir William Osler was Regius Professor of Medicine.[26]

To my own thinking, among the characteristics which endeared Osler to his friends none was perhaps more striking than his combination of an intense affection for the past, and not least

for the antique past, with an enthusiastic receptivity for the new, a sort of open-arms embracing of the future. To run his eye backward and forward along the historic continuity of Medicine seemed with him a daily and hourly habit. No man, I think, was ever less open to the misconception of the present as a moment apart, a thing that was stopping still to be looked into, and was intelligible by itself alone.

It is said that Osler sometimes irreverently referred to Sir Clifford Albutt, his counterpart at Cambridge, as 'my brother Reggie'. Albutt, on whom George Eliot based Lydgate in *Middlemarch* was a pioneer in the use of the ophthalmoscope and sphygmomanometer and introduced the terms 'choked disc' and 'hyperpiesis'. He had practised in Leeds before being appointed Regius Professor of Medicine at Cambridge.

Sherrington wrote of him:[27]

. . . his vitality overflowed like an influence on all about him. Few, of whatever career, can have combined attainments and a distinction of personality and of person such as met in him. Of many and wide interests, some of them seeming little compatible, such as scholarship and public professional service, these were in him united into the one harmonious outstanding figure admired of us all.

Osler, a Canadian by birth, who came via Montreal, Philadelphia, and Baltimore to Oxford is commemorated by the eponyms 'Osler's nodes' and 'Vaquez-Osler Disease', but greater than any clinical achievement was the influence he exerted by force of his genial and remarkable personality. To this cultured man Oxford was a delight and Sherrington remarked:[28]

. . . that his position should link him with Linacre, Sydenham, and Harvey rose, I think almost daily to his thought. Not that he lived in the past; rather he trod a stage whose scenery was much of it furnished from the past. The very buildings had their fascination for him. Once as I walked alongside him across the open space between the Camera, the Bodleian, and All Souls, he stopped and, looking round, said: 'The finest architectural view in Europe'.

Sherrington was himself susceptible to the spell of Oxford and described it movingly as it appeared to him on a summer evening.[29]

> And now, below, through shadows starr'd, a boat
> Steals by me laden with singing and young laughter,
> And, higher, a wide-flung casement casts afloat
> Pulses of waltz the which white robes sway after;
> Vowed Priest of Beauty, these thy shrines among,
> Thou kneelest with old folk, thou that dancest with young.

He shared with Osler an appreciation of the past; an awareness that the achievements of the past continue to live in the present.[30]

The work of Harvey, the spirit of it no less than the import of it, provides his eulogy and makes superfluous all other. His great discovery, aside from its intellectual worth, secured an item of knowledge than which no other single item has so served to grow, as from a seed, medicine as we know it. And it was the reassertion, the rebirth of the method of experiment which, wedded to observation, had created the medicine—and the surgery—of the civilized world to-day. To engender medicine anew is to engender a whole world of correlated knowledge; and an

attendant world of beneficence no less. The circulation of the blood, the meaning of the heart, the light of a victorious method! May we not affirm that modern medicine does in fact start there? Harvey, founder of modern medicine! He would himself have felt no term can carry richer or lovelier praise from a grateful world.

He also wrote revealingly of a great figure from the more recent past, Lord Lister, whose earliest paper (not surprisingly for the son of Joseph Jackson Lister who gave to the world the achromatic microscope) was on the contractile tissue of the iris, and whose second paper, too, dealt with involuntary muscle.[31]

We may be struck by the remoteness of these Lister's first themes both from surgery and indeed from actual practice—they are frankly academic. I think we have to picture him as a young man to whom the thing that really mattered was to engage at once upon research, caring less what in particular the research might be; a young man so ardently curious about Nature, especially animate Nature, that he turned enthusiastically to the problem that came first to hand.

Lister's third paper was on the cellular nature of smooth muscle. By this time another subject was attracting him.

His scientific enthusiasm had indeed definitely orientated itself towards a chosen quest in the great field of the unknown. His spirit of inquiry had found a direction of overpowering interest to it. In his own words, written to his father, he had fallen in love with surgery; and with that widely detailed and highly technical art and calling prospectively spread before him, the genius within him impelled him to study not so much this or that particular skill or difficulty, but the fundamental and all-pervading process of inflammation itself as being for him the one prime and central problem for investigation.

Goethe, a poet and scientist, interested Sherrington greatly but he thought little of the famous writer's capacity in the latter sphere.[32]

Were it not for Goethe's poetry, surely it is true to say we should no longer trouble about his science. Such as it was, it is as science not important. Its importance lies in the light it throws on Goethe the poet, and on his conception of Nature. It documents him as a poet-pantheist. He thought about Nature over and over. . . . Creative genius in literature, in science his genius longed to create. It would not always abide the waiting for further experiments and more knowledge. Science has to follow experiment where possible, even where the imagined seems extremely probable. Goethe, though devoted to science, had not at root the scientific temperament. He had not, for instance, along with the urge to discovery the sublime detachment of the scientific thinkers.

Among the poets Sherrington, well-read in the literature of several languages, had two favourites, Shakespeare and John Keats who had written his famous sonnet on Chapman's Homer in the street where St. Thomas's Hospital formerly stood. His own book of poetry, *The Assaying of Brabantius and other Verse* was published in 1925; a second and larger edition appeared in 1940.

The poetry of a man deeply acquainted with Nature's secrets, with truths hardly wrested from the universe might be expected to be interwoven with relevant images and with tokens of this struggle. Here, if ever, one might hope to find ions and reflex arcs, retinal pigments and cellular ferments, osmotic

processes and nuclear mitoses joined in metrical assonance. To approach Sherrington's poetry with such apprehensions is to court disappointment: the sustained note one finds is of nostalgia. His thoughts are of young men wasted in Flanders and of the days of his youth.

> And still to have close by
> The loved heads that were grey,
> The calm faces stooped anigh
> With the high word to say.

One sonnet describes how speech came:

> . . . to use and read lip's breath,
> More fine than strings, more passionate than thunder,
> Bridging the dumb abysses round and under,
> That thought reach thought exchanging what soul saith

and ends with a sentiment giving no hint whatsoever of physiological insight:

> Yet finds the soul ev'n now, though its bars broken,
> The fairest thoughts are still the thoughts unspoken.

Once only does the scientist speak:

> Ribbed breathing flesh, thrice often crucified,
> Veined vase of life, the wheeling universe
> Has shapen thee, for better or for worse,
> And still is shaping, out of old Earth's side.
> Launched from primeval clash of rock and tide,
> Thence hither on, with wayfaring perverse,
> Thy fashioning still goes forward even as theirs,
> The stars in flow that sphere from vapours wide.
>
> How camest thou by that strange gift ungiven
> To aught else earthly, Eden's fruit forbidden,
> To know thyself, as part to glimpse the whole?
> And, that within thee, clasping earth and heaven
> For comrades of like faring, storm beridden,
> To face, brow-raised, the incognizable goal?

We find the explanation for his reluctance to enshrine the sublimities of science in verse in his review of *The Poetry of Geology* by K. K. Hallowes.[33]

> To define poetry is indeed difficult; yet all its attempted definitions regard as its essential its drive to emotion—it must be able to move us. Geological knowledge, charged with remote, with prehuman and superhuman, immensities as it is, seems humanly too impersonal to imply emotion for the general reader. Such poetry would somewhat resemble religious poetry, which for the general reader conspicuously fails as poetry. Keats, passionate admirer of Milton's genius as he was, yet felt the Miltonic epics would lose appeal at a future day because their main theme was not essentially poetical.

But if science is excluded from his poetry at times his prose is lyrical as in this description of the investigation of spinal reflexes.[34]

Hughlings Jackson describes 'dissolution' his great analyst of the nervous system, as pulling to pieces from the top downward to descry variously far. So likewise physiological experiment, but, for simplicity, starts lower. A rump of mechanism, a stump of spinal cord, these it interrogates through perhaps a single afferent for answer by a single efferent. Such virtuosity has of course its defects; one of them is the mutilation entailed. But its hope is, since bottom is basal, to reach bottom; though even there the elemental may not prove to be the simple.

His account of the cell is highly dramatic:[35]

Essential for any conception of the cell is that it is no static system. It is dynamic. It is energy-cycles, suites of oxidation and reduction, concatenated ferment-actions. It is like a magic hive the walls of whose chambered spongework are shifting veils of ordered molecules, and rend and renew as operations rise and cease. A world of surfaces and streams. We seem to watch battalions of specific catalysts, like Maxwell's 'demons', lined up, each waiting, stop-watch in hand, for its moment to play the part assigned to it. Yet each step is understandable chemistry.

Although it is fluid and watery, most of the cell is not a true solution. A drop of true solution, of homogenous liquid could not 'live'. It is too remote from 'organisation'. In the cell there are heterogeneous solutions. The great molecules of protein and aggregated particles are suspended not dissolved. A surface is a field for chemical and physical action. The interior of a pure solution has not surfaces. But the aggregate of surfaces in these foamy colloids which are in the cell mounts up to something large. The 'internal surface' of the cell is enormous. The cell gives chemical results which in the laboratory are to be obtained only by temperatures and pressures far in excess of those in the living body. Part of the secret of life is the immense internal surface of the cell.

In the spongework of the cell foci coexist for different operations, so that a thousand different processes go forward at the same time within it. The foci wax and wane as they are wanted. That the cell's field is a colloidal field makes much explicable. The total system is organised. The various catalysts work as co-ordinately as though each had its own compartment in the honeycomb and its own turn and time. In this great company along with the stop-watches run dials telling how confrères and their substrates are getting on, so that at zero time each takes its turn. Let that catastrophe befall which is death, and these catalysts become a disorderly mob and pull the very fabric of the cell to pieces.

Nor is humour missing from his addresses. An advocate of women in medicine he spoke at the London School of Medicine for Women:[36]

Reform is rarely facile. It is not, as Rousseau taught, a simple return to nature. Perhaps, like the ancients, he thought us descended from the gods. But after him came Darwin. It is a long ascent from the grimaces of the ape to the smile of Mona Lisa. But one sex has accomplished it, and it speaks to the comfort of both. A mere man, I have myself had homely reminder of mental kinship to primitive forbears. When my laboratory kept chimpanzees I used to pay a daily visit to them at large in their room. Once after such a visit, when I had just left and locked the door I turned back again, pondering what the chimpanzees might do when I had left; I stooped and looked through the keyhole. A chimpanzee's eye met mine peering through the keyhole. The same thought had struck us both, both her and me—she, as a lady, had acted first. When the human community about you seems slow in development recall my case. Surely it is encouraging that despite my mental resemblance to simian stock the convincing logic of your cause stands plain even to me.

Through the Royal Society of which he became a Fellow in 1903 Sherrington was in contact with the best scientific minds of his age. During his Presidency (1920–5) he presented the Sylvester medal to A. N. Whitehead and the Copley medal to Einstein.[37]

The name of Einstein is known to everyone through his theory of relativity which he originated in 1905 and extended by a notable generalization in 1915. Einstein realized that the time and space with which we are so directly acquainted by experience can be no other than the fictitious *local* time and space of the moving system—the motion in this case being that of the earth; and we have no means of determining, nor can physical science be concerned with, any absolute reckoning of space and time. After this Einstein was led to the identification of mass with energy—another result of far-reaching importance, which allows us to know the exact amount of the store of energy so tantalisingly hidden within the atom.

At Gloucester he unveiled a memorial table to Sir Charles Wheatstone, pioneer of the electric telegraph, inventor of the 'Wheatstone bridge' and the stereoscope. The latter entailed the[38]

. . . discovery that the mind can, from two flat but slightly dissimilar pictures simultaneously presented to the eyes, obtain in full perspective and with startling distinctness the third dimension of sensual space. It is interesting that to Wheatstone, the physicist, should thus be due a fundamental observation in modern psychology bearing on the synthetic powers of the mind.

Sherrington was awarded the Copley medal in 1927. He retired from Oxford in 1935 but retirement did not mean a cessation of activity. His Gifford Lectures at Edinburgh (1937–8) were published as *Man on His Nature* in 1940, and in 1946 when he was eighty-nine *The Endeavour of Jean Fernel* was published. In 1949 a revised, extended and annotated edition of *Goethe on Nature and on Science* appeared.

Of Goethe facing death Sherrington wrote: 'What this great change meant he was too wise to think he knew.' And surely, penning those words, he must have pondered on his similar plight. Some years yet remained to him and though by now physical frailty and arthritis had incapacitated him and he was partly blind and rather deaf his intellect and wisdom were unassailed.

Lord Brain who occasionally visited him in an Eastbourne Nursing Home during those last years has recorded fragments of his conversation and given us a picture of him, enfeebled, but unchanged in essence:[39]

. . . from the chair to which his arthritis confined him his mind still roamed and questioned. There was still the same pause to find the right word; the same contraction of the corrugator, and then of the frontalis muscle, drawing the brow upward and to the left; the same deliberate chuckle.

Sherrington's thoughts ranged from that far-off day when he had spoken excitedly to Lister telling him how he had saved his own nephew's life with diphtheria antitoxin (the first clinical use of diphtheria antitoxin of English origin) to the question of how much pain was felt by experimental animals. He thought monkeys and apes felt little pain. He could visualize a rhesus monkey 'sullen, stony, stoical'.

He considered that thoughts then current about the nervous system were much too simple. He repudiated the assertion that all behaviour is reflex. 'You don't think what we are doing now is reflex, do you? No, no, no!'

He continued to affirm that for him brain and mind are incommensurable.[39]

He saw no prospect of bringing the brain and the mind together: it might take 400 years. Even if the brain is an electrical machine, how does this bring us nearer the mind? Take Shakespeare's plays—they are in a different world from electrical patterns. Moreover, the mind is not in space: not even Einstein's fourfold space makes it any easier.

Sherrington died instantaneously from acute heart-failure on 4 March 1952 in his ninety-fifth year. A few days previously he said to Professor Eccles:[39] 'Keep on struggling for the reality of the spirit. It is something the world needs.' And one of his last recorded comments was: 'For me the only reality now is the human soul.'

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EAST LONDON HOSPITAL FOR CHILDREN

ON 30 April 1963 the hospital formerly known as the East London Hospital for Children was closed, a few years before reaching its centenary. This institution originated in January 1868 in a warehouse in Ratcliff Cross. Dr. Nathaniel Heckford of the London Hospital, the founder, when working with his future wife Sarah Goff during the 1866 cholera epidemic in Wapping, saw the great need for a children's hospital in East London. The original building contained ten beds which were later increased to fifty, and was the first hospital in London to admit babies under the age of two years. Public generosity was stimulated by Charles Dickens, who publicized his visit to this 'small star in the East'. Dr. Murray of the *British Medical Journal*, on behalf of the Editor, also emphasized that financial support was 'direfully needed' (*Brit. Med. J.*, 8 February 1868). In the same journal Dr. Heckford, writing about special institutions, stated that 'qualified men would benefit by attending such hospitals where they would learn more and where, from the special influences and interests at work, the patients would gain morally and physically'; thus he anticipated the present demand for postgraduate training.

The need for larger premises resulted in the building of the hospital at Shadwell, but Dr. Heckford, who died of consumption in 1871 at the age of twenty-nine years, did not live to see its foundation. The hospital on its new site was opened in 1877 by H.R.H. the Duchess of Teck. The original 180 beds were later in 1881 increased by the addition of a further floor.

This voluntary hospital continued to thrive and gradually acquired an international reputation. In 1932 the name was changed to the Princess Elizabeth of York Hospital for Children and later in 1942 this hospital with the new country branch at Banstead was amalgamated with the Queen's Hospital, Hackney Road, to form the Queen Elizabeth Hospital for Children. With the closure of the hospital in Shadwell, the paediatric work is now being actively maintained by the Hackney Road and Banstead branches of the Queen Elizabeth Hospital. Today with the rising birth-rate and the changing emphasis of paediatrics there is still a need for the special care of infants and children in hospitals, where training in this particular branch of medicine can be sought as in Heckford's day.

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