

MIND AND BRAIN¹

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SOME years ago, in a Hughlings Jackson lecture, I ventured to give some personal views upon the nature of the relationship of mind to brain. I said nothing original, yet something rather different from what we are accustomed to hear in those popular symposia on the brain-mind relationship, or upon brain mechanisms and consciousness, of which we have had a number of examples in recent years. The views I expressed had the sanction of philosophers from Aristotle to Aquinas, and, in a measure, of such physiological geniuses as Hughlings Jackson and Sherrington, but there is little interest in them at the present time in a scientific world still intensely preoccupied with the concepts of cybernetics and biophysics: preoccupied in the sense that some scientists find they cannot easily entertain any concepts which transcend these fragmentary ideas.

How we approach this problem depends largely upon our concept of nature and of natural science. Therefore, I define natural science as being 'the study of nature as perceived: a study wherein nature is disclosed as a complex of entities whose mutual relations can be thought of and discussed without reference to sense awareness or thought about it'. This is to say that we can be perfectly good natural scientists without bothering our heads about the nature of perceiving, or the theory of knowledge—epistemology, as it is called. This is a complex definition, which I have taken from a great mathematician and philosopher, Alfred North Whitehead.² Its full import will appear later, but in the meantime I wish to point out that nature, that is, the world as perceived, does not comprehend all that the human mind can entertain. Science is but one universe of discourse, and he would be a bold man who maintained that there is no other possible universe of discourse about man than that of natural science. I say 'a bold man'; perhaps I should have said a foolish one.

Yet, for many scientists, their scientific knowledge is almost wholly confined to what may be observed in circumstances so out of the ordinary that they do not happen in the natural course of events: to take a familiar example, the punctate electrical stimula-

¹ An address given in the University of Cincinnati College of Medicine, April 1959, and reprinted by the kindness of the *Journal of Medical Education* (University of Wisconsin).

² A. N. Whitehead. *Modes of Thought*, Cambridge University Press, 1938.

tion of the surface of the cerebral cortex, a form of procedure grossly unphysiological and therefore biologically irrelevant, as von Frey pointed out many years ago. These scientists use carefully constructed instruments and apparatus, laboratories strictly protected from outside influences, and workers trained by complex and special methods before anything can be observed that they are willing to accept as revealing the irrevocable causal laws of nature. Anything that makes ordinary natural occurrences differ from laboratory events must be cleared out of the way, and ignored as though it did not exist. The 'clearing out' is valid enough, but the total ignoring of what has been put in the discard not rarely vitiates the conclusions drawn as a result of this 'cooking' of the sum of the facts, and constitutes that common vice of the intellect, the misuse of abstraction.

Surely, when we have banished from our thoughts everything outside a scientific laboratory, what a mutilated and poverty-stricken universe there remains for our contemplation. Is it not surprising, then, that we should find distinguished scientists who really believe that there is nothing in the mind and intellect of man that cannot be described in terms of, and as being no more than the expression of, the activities of neurones: in short, in terms of the sodium-potassium pump, or the bloodless dance of action potentials? For them, as I have said before, the sonnets of Shakespeare, the *Primavera* of Botticelli, and the untold goodness and heroism of unknown thousands of human souls, are no more than the fruit of reverberating circuits and feed-back mechanisms in the brain. I am not joining these self-confessed robots in their chill and ephemeral paradise. Of course, not all scientists live out their lives in blinkers like this, but it seems to me that those who tend to monopolize the literature on the brain-mind problem, and have such an inordinate influence on the young, do have these simply-reacting neural dispositions—I must use this term for men who deny the concept of mind.

It is because I reject this outlook that I ask your indulgence to hear a point of view rarely put before you. I realize that to do this in a scientific institution is to put one's foolish head in a lion's den, but every point of view is entitled to an occasional ventilation. First let me say that it is the mind of *man* I am concerned with, and not with the feeble glimmerings that the anthropoid can show or the popular and cheaper rat, whose learning processes, such as they are, we commonly and unscientifically assume to be exactly the same as our own. Aristotle defined man as a rational animal, and the definition stands, even though there are irrational elements in man,

and he is not continuously rational. Even the thought of the scientist is coloured emotionally, and the notion that reason acts in an emotional vacuum is a high abstraction. Nevertheless, man is a rational animal. This rational element in man distinguishes him from all other animals, even though he share their animality. Of a man it may be said, not only *what* he is but *who* he is—he has personality. His hallmarks are self-conscious activity, the faculty of abstract thought: that is, of forming concepts apart from their embodiment in particulars; he has conscience and a moral sense, the capacity to know and to seek perfection, and he enjoys the entertainment and communication of thought and feeling by articulate speech. Man is aware of his innate limitations and dependence: that is, he is imbued with natural religion.³ This is why concentration upon the animal element in man to the exclusion of his rational element is illogical, unscientific, and intellectually disastrous. Moreover, I submit, this nature peculiar to man is not amenable to analysis by the disciplines of natural science: its study belongs to philosophy and theology.

It is from these premises, which transcend the natural sciences, that I start, and it may well be that some of you have parted company from me already. At least, I beg that you may listen to me. What I have to say will be a change from the confident, reiterated and bleak pronouncements of those who believe that there is nothing in the human mind and in the soul than the biophysical activity of neurones; that to speak of mind is merely to talk of neurophysiology in a different language, but not to talk about something else; that philosophy, which is the study of the ultimate causes of things, is a mere linguistic exercise of which the adequate textbook is the dictionary, and that it has no basis in experience considered in abstraction.

I am not presuming to discuss this problem as a theologian or as a philosopher, which I should have no right to do, but, if you will allow me, as a physiologist, seeking to discover how far my science will take me to the frontier of the mind, whether the activities which express the mind in action can be described in the language of physiology, or require the qualitatively different language and ideas of psychology, and whether the theory of knowledge, of how we know, can be adequately discussed in the language of psychology, or needs a philosophical language—which operates on a higher level of abstraction than does that of the natural sciences and psychology. My answer is going to be that these three things: abstract or conceptual thinking, sensory experiences, and the

³ A. J. E. Cave. *Proc. Linnean Soc.*, London, 163:1, 1952.

activity of neurones—however complex the last may be—are three distinct and irreducible categories, each with its own language and concepts.

Speaking purely as a physiologist I am logically restricted to the language of physiology in which is discussed—for my present purpose—the dynamic properties of the nervous system, and these alone. I am not, *qua* physiologist, qualified to discuss human actions or human ideas. These are the field of psychologist and philosopher. I think this standpoint is absolutely essential to clear thinking, but it is not generally held, and so we find experimental psychologists and disciples of cybernetics using what I shall call 'double talk' in which conceptual thinking and sensations are described in cybernetic and biophysical metaphors; while in a single paper on, let us say, consciousness, we may find the writer using the language of anatomy, physiology, psychology and philosophy indiscriminately as though they were a single language, and a single universe of discourse was in question.

I give you a simple example from a recent monograph upon 'Brain: Memory and Learning' (Ritchie Russell),⁴ an excellent monograph on its clinical side, where the writer says, 'The traditional reasons for separating mind from brain seem to be disappearing, and in the same way the separation of psychology from brain physiology has become somewhat artificial'. Again we read, 'Consciousness is simply the occurrence of cerebral alertness'. From the first quotation, I submit that we must wholly dissent. As Hughlings Jackson said, 'There is no more a physiology of the mind than there is a psychology of the brain', while the equating of consciousness with 'cerebral alertness' is a pure tautology, and the sentence would mean as much or as little if we put it back to front and made it read, 'cerebral alertness is simply the occurrence of consciousness'.

What precisely is cerebral alertness? 'Alertness' is not a word in the grammar of physiology. Head's term, 'vigilance', is also coming into use in the same sense. Head never defined it, and its modern users do not do so. They cannot, for it is indefinable in the language of physiology in which they seek to put it. Even worse hybrids than 'cerebral alertness' or 'spinal vigilance' are to be found unrebuked in our literature: for example, the proposition that some cell groups in the brain stem can be the 'seat of wisdom and the place of understanding'. We cease to talk sense when we confuse our categories in this fashion.

As I have said, I adhere to the Aristotelian and Thomist views of

⁴ W. R. Russell. *Brain: Memory and Learning*, Oxford, Clarendon Press, 1959.

man as a compound of matter and form: that is, as the union of the corporeal and the spiritual: this union in man differing from that in animals, in that the soul in man is able to exist apart from matter (cf. Maritain⁵). Yet I must not presume to discuss theology and philosophy, and I drop back—for the purposes of this talk—to the somewhat more negative attitude which has been propounded by those two great scientists, Hughlings Jackson and Sherrington. In their written works, neither of these men concedes the notion of the soul as understood in the sentence I have just uttered. Indeed, by those who knew him, Jackson is said to have been an agnostic in religion, while Sherrington, at the date of his Gifford lectures,⁶ also denied the concept of an immortal soul—though I have my own doubts as to whether this was his final judgment in his last years.

However, this is not to the purpose, but what is germane is that both men explicitly rejected the notion that mind could be accepted as something within the realm of physiology or physics, or, as Sherrington put it, within the energy system. They thought the two irreducible. This issue, then, is not solely or inevitably one of religious belief. It was in both these men the expression of their conviction that mind could not be accounted for in terms of neural activity, even though the latter was a necessary condition of the former. The relationship between the two is not one of identity, it is not even a symmetrical one, for while mental action involves neural action, neural action does not always involve mental activity. Jackson adopted the doctrine of psychophysical parallelism, not as a doctrine, but as a convenient working hypothesis only, in his consideration of the nervous system. Sherrington saw nothing more strange in man considered as essentially dual than in man conceived as not dual. Sherrington has been called a Cartesian, but this was not strictly true, for Descartes confessed to no ignorance, while Sherrington's dualism was based simply upon his inability to equate brain and mind, and his rejection, or, more probably, his unawareness, of the hylomorphism of Aristotle and Aquinas.

It took some courage for both these men, i.e., Jackson and Sherrington, openly to avow this outlook, for in Jackson's time the nineteenth-century positivists with their abounding confidence in the finality of science as they knew it, and their ignorant contempt of metaphysics, were firmly in the saddle, while today the amazing developments in neurophysiology that we owe to the electronic recording techniques now available have once more filled some

⁵ J. Maritain. *Introduction to Philosophy*, London, Sheed and Ward, 1946.

⁶ C. S. Sherrington. *Man on his Nature*, Cambridge University Press, 1940.

scientists with a naïve optimism that we are almost on the brink of identifying brain with mind. Grey-Walter,⁷ for example, thinks that it is only a question of careful observation and patience before we can observe as electrical discharges the thoughts of our own brains. Electrical discharges are not thoughts, and never can be the whole explanation of thought. They are not even entitled in a strictly rational terminology to be called 'information' as they now frequently are called.

Let us, indeed, reduce the electrical discharge from the neurone to its proper place. It is no more than a single expression—revealed by a particular piece of apparatus—of the sum of the vital processes within the neurone, which, like any other living cell, has its own private life over and above its specific function as an impulse conductor. The neurone has its own metabolism, respiratory, and enzyme activities of which electronic recording tells us nothing directly. In other words, the electrical discharge just happens to be what we have been able to fish up out of the depths of the neurone's life processes, with the particular electronic net we are using, and we may not assume that there are no other fish in the sea.

It is refreshing in this climate of the cybernetic and biophysical concepts of a mind substitute, so eagerly pressed upon us by the 'angry young men' of science, to find Adrian, in his obituary of Sherrington, written for the Royal Society, commenting as follows: 'I personally believe that his neo-Cartesian doctrine of the duality of mind and brain will be eventually regarded as one of his greatest conceptual achievements. Sherrington realized', Adrian continues, 'that his philosophical writings had come at a time of an unfavourable climate of opinion, but, despite the misunderstandings of the critics, he continued indomitably to believe that man is both matter and spirit and that spirit is supreme.' However firm one may feel in one's own convictions upon issues such as this, which have exercised the minds of men since the dawn of history, it is still comforting to feel that one is in good company in holding them, and that in due course our angry young men may grow up to realize that they have not solved the riddle of the mind and of *how* we know, despite their batteries of equipment, their mathematics and their statistics. They may not be willing to look back upon the history of thought on this subject in times past. It would perhaps be easier for them to appreciate the difficulties of their search if they had a greater historical sense than they commonly display, and its lack may explain why some of them do not grow up. Our Peter Pans of science are always with us.

⁷ W. Grey-Walter. *Arch. Internaz. Stud. Neurol.*, Firenze, 1:409, 1952.

It seems to me, then, that both Jackson and Sherrington halted at the frontier between brain and mind. Insofar as they were natural scientists, concerned with nature as perceived, I think they were right to do so. This may seem an odd conclusion to those who accept that psychology and psychiatry belong to the natural sciences. Insofar as psychology deals with the physiology of the special senses, it is really physiology, but insofar as it deals with human motives and actions, I believe it does not belong to natural science, but is related to historical science. I cannot fully develop this theme at the moment, but those who wish to see its exposition will find this in the work of an English historian and metaphysician, Collingwood, in his book *The Idea of History*. He presents a case that demands an answer, and I have summarized it in a Linacre Lecture in 1950.⁸ Thus, both Sherrington and Jackson are in a class apart from those of the present time who deny the concept of mind and tell us that feedback mechanisms in the cortex can know universals: that is, are capable of conceptual thinking.

Whitehead, to whom I have already referred, in his volume of lectures entitled *Modes of Thought*, reminds us that 'Mentality involves conceptual experience: that is, the entertainment of possibilities for ideal realization in abstraction from physical realization. It involves the entertainment of alternatives, and "in this entertainment mentality reaches its highest development and becomes the entertainment of the ideal, and shows itself in several species, such as the sense of morality, the mystic sense of religion, the sense of that delicate adjustment which is beauty, the sense of necessity for mutual connections that is understanding, and the sense of discrimination of each factor". All this produces the history of mankind as distinct from the narrative of animal behaviours.'

Yet all this, we are now told, can be achieved by the activities of nerve nets, which can know universals and thus can take over the business of what Aristotle and Aquinas knew as the active intellect. I cannot here go into the arguments by which these cybernetic hypotheses are illustrated. They will be found in the volume of essays entitled *Perspectives in Neuropsychiatry*,⁹ but I do go on to say that the arguments are vitiated because it is perfectly clear that the writers are profoundly unfamiliar with the history of the term 'universal': a long and difficult history from Greek to medieval times. How, indeed, should biophysicists know their Greek or

⁸ F. M. R. Walshe. *Humanism, History and Natural Science in Medicine*, Edinburgh, E. and S. Livingstone, 1950.

⁹ D. Richter. *Perspectives in Neuropsychiatry*, London, H. K. Lewis, 1950.

scholastic philosophy, and how rash of them to have borrowed this term from a discipline not their own.

Here, again, I cannot develop this thesis, but my views upon it may be found in *Brain*, 1953, in my Hughlings Jackson Lecture. Yet a really distinguished name of our time attaches to the notion that mind is no more than brain, and brain no more than physics and mathematics can define, namely that of Lashley, a man of great physiological insights, but no friend of the science of ultimate causes. Lashley expressed the view—speaking in the Hixon Symposium¹⁰—that ‘our common meeting ground is the faith to which we all subscribe, I believe, that the phenomena of behaviour and mind are ultimately describable in the concepts of the mathematical and physical sciences’. I see no grounds upon which I should be invited to join in this act of faith, as Lashley—perhaps with unconscious irony—calls it. My deepest intuitions tell me that physics and mathematics are singularly inadequate to subsume the human mind, and I surmise that it is not the mathematicians who hold this lofty notion of the powers of mathematics, but rather those biologists who think that an equation is an explanation.

As far as I can discover from my limited studies in comparative anatomy and animal physiology, there is no evidence that the neural processes in the brain of man differ in any qualitative fashion from those in lower animals that possess a nervous system. Are our reverberating circuits, our synaptic potentials, our feedback mechanisms in any sense different in quality from those of animals? They are more extensive and more complex, but not different in kind. In man as in the humble squid the nerve impulse originates and goes on its way owing to the same sodium-potassium exchange, the same order of electrical activity. Yet how different are man’s conceptual powers from any other creature in the animal world. Here again I turn to Whitehead (*loc. cit.*), who says, ‘When we come to mankind, nature seems to have burst through another of its boundaries. The conceptual entertainment of unrealized possibility becomes a major force in human mentality. The life of a human being receives its worth, its importance, from the way in which unrealized ideals shape its purposes and tinge its actions.’

Thus, the most we dare claim for neuronal circuits in action is that they integrate the ceaseless and changing flux of afferent impulses from the receptive periphery, and the constant activity within what Herrick calls the neuropil: that is, the synaptic fields of the cortex and the brain stem. They cannot and they do not

¹⁰ K. S. Lashley. *The Problem of Serial Order in Behaviour*, New York, John Wiley and Sons, 1951.

provide conceptual knowledge as such, nor include any appreciation of the true universal. Here no nerve networks, however complex, can serve, for we pass out of the material world in which alone they function and find ourselves in an immaterial world of ideas. The bridge between the two necessarily implies the existence of non-material faculties capable of effecting the transformation.

Thus it is that from sheer philosophical and psychological necessity, traditional commonsense philosophy from the early Greeks to Aquinas has accepted the existence in man of an essential immaterial element, capable of such transformation and setting him above the merely animal. This element has been variously named as psyche, entelechy, anima, or soul. They recognized that, for the soul's functioning as an essential element in the hylomorphic human person, it needs sense data of which the brain is no more than the collecting, integrating, and distributing mechanism.

If, then, as I submit, we cannot invoke nerve nets and their activities as able to know universals, the first property of the active intellect, then we must either abandon the quest for an account of mind that shall explain its place in man's nature, or look elsewhere for it than in the concepts of physiology, physics, or mathematics. We must abandon the assumption that the human person is nothing more than a focus for the hurrying to and fro of molecules and their constituent postulated elements, or his mind no more than a bloodless dance of action potentials.

We have seen one scientist making his act of faith that ultimately the problem of mind will find its solution in the concepts of physics and mathematics. Each of us has the inalienable right to make his own act of faith, and mine is this: that these concepts are of their nature inadequate to subsume the activities of the human mind; to think that by additional knowledge they can become so is wishful thinking; and, finally, I believe that we shall have to return to the ancient concept of the soul: as an immaterial, non-corporeal part of the human person, and yet an integral part of his nature, not just some concomitant component, but something without which he is not a human person.

I subscribe to the belief that man's mind and soul are not to be wholly interpreted in terms of nerve impulses, but that there are values in his life, religious, ethical, and aesthetic, not to be comprehended in terms of action potentials. I am not ready—when I view the unceasing flux of scientific knowledge and opinion—to confine the Universe within the procrustean bed of those proximate causes, different for every generation, which seem to so many scientists all that there is to be sought. We all know the nursery tale of Simple

Simon who went fishing for whales in his mother's pail. I am happy not to find myself in the ranks of those scientific Simple Simons who believe that with better hooks, lines, and baits, pitched into the same pail, they will fish out from it the answer to the riddle of the soul and the mind. The whale isn't in the pail! I cannot put more succinctly and clearly my own personal view of the Universe in which I have lived, and of the natural scientist's strictly limited role within it.

We live in at least two worlds, the world of the humanities and the world of science. The former cannot be reduced to the latter. Perhaps I may end by quoting from Sir Gavin de Beer a cruel parody in which we get the report of a committee of scientists upon a symphony concert. It runs as follows:

(1) For considerable periods the four oboe players had nothing to do. The number should be reduced and the work more evenly spread over the whole of the concert, thus eliminating peaks of activity.

(2) All the twelve first violins were playing identical notes. This seems unnecessary duplication. The staff of this section should be drastically cut: if a large volume of sound is required, it could be obtained by means of electronic amplifier apparatus.

(3) Much effort was absorbed in the playing of demi-semi-quavers. This seems an excessive refinement. It is recommended that all notes should be rounded up to the nearest semi-quaver. If this were done it would be possible to use trainees and lower-grade operatives more extensively.

(4) There seems to be too much repetition of some musical passages. Scores should be drastically pruned. No useful purpose is served by repeating on the horns a passage which has already been handled by the strings. It is estimated that if all redundant passages were eliminated, the whole concert time of two hours could be reduced to twenty minutes and there would be no need for an interval.

I should spoil this fable if I said any more.

In conclusion, I should like to guard against a misunderstanding that my remarks may cause, and, indeed, have caused in the past when I have voiced such sentiments as you have heard from me today: namely, the erroneous conclusion that I think the study of the functions of the nervous system a useless pursuit, and that I deprecate the efforts of those scientists who so ably and so tirelessly continue to seek for a fuller understanding of these functions. I yield to no one in my respect and admiration of good work and good workers in this field. Yet to cherish these sentiments need not

allow one to forget the necessity of the use by anatomists and physiologists of a precise and appropriate terminology, or the need for consistently used and logical principles of interpretation in scientific observation.

We have the right to ask for a terminology in physiological writings that is precise and physiological, and free from admixture—witting or unwitting—of terms from two other disciplines, philosophical or psychological, as though they belonged to the grammar of physiology; free also from the easy recourse to popular terms of no precise or constant reference, used to fill up gaps in scientific knowledge and to conceal their existence.

No reader of the relevant literature would deny that these standards of scientific language do not universally obtain today. The departure from them confuses thinking and expression and leads us unwittingly to the seeking of false goals far beyond the proper scope of natural science, and to the engendering at times of an absurd intellectual pride: and by that sin fell the angels.

CHRISTIANITY AND THE WORLD RELIGIONS

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EASE of communications brings all men together: but the contiguity of bodies does not necessarily entail the cross-fertilization of minds, and the mere fact that we can now move round the world at incredible speed does not mean that we are any better equipped to appreciate the ideas and cultures of other lands. Indeed it can be argued that the enormous development of the tourist traffic in Europe has done more to emphasize national peculiarities than to promote international good will: mere physical contact between nations does not necessarily lead to better understanding.

That there is need for better understanding, however, few would deny; and it is only since the last war that Europeans have come to realize it. For it is quite certain that the last war put an end to European supremacy for ever; and Europeans, so long the master race, will now have to learn the hard way how to get on on equal terms with peoples they had previously dominated. Moreover,