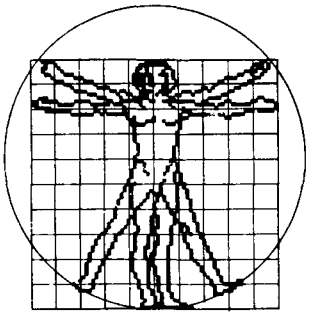
A Loose Wheel Spinning

Sherrington's Man—By T. D. ROGERS



"FEW THINGS", wrote Bertrand Russell, "are more firmly established in popular philosophy than the distinction between mind and matter. Those who are not professional metaphysicians are willing to confess that they do not know what mind actually is or how matter is constituted, but they remain convinced that there is an impassable gulf between the two and that both belong to what actually exists in the world."[1] This historic dichotomy remains as fixed in the popular imagination as ever, despite the earnest endeavours of philosophers and physiologists to bridge the gulf. Next year will see the 50th anniversary of the publication of Sir Charles Sherrington's classic text, *Man on his Nature*,[2] a work which represents a highpoint of 20th-century scientific writing—and arguably the single most important assault on Cartesian dualism.

In his 1937-38 Gifford lectures at Edinburgh University, which had provided much of the material for his book, Sherrington had stated the problem in new terms:

> "These two concepts (energy and mind) divide, and between them comprise, our world. How can the phenomena of the two (space-time energy and non-space mind) interact? The more the biologist studies life the less I fancy does it seem to him like life to have a loose wheel spinning. Yet how shall a spatial wheel cog into unextended mechanism or the non-spatial drive a spatial wheel?"

In the course of answering this ancient riddle, Sherrington paints a vivid picture of the human brain—"an enchanted loom where millions of flashing shuttles weave a dissolving pattern". But he goes much further than a mere description (albeit graphic) of the brain's hardware; he anticipates the general thrust of neurobiology and evolutionary theory over the subsequent half-century.

Sherrington makes explicit in a way never before attempted, and seldom since, the full implications of a materialist biology:

> "Science tells man that he is a product of nature. Broadly taken, he is a product of his planet and its sun. Even his mind which would seem most to differentiate him is of the natural world. Its origins trace thence; its climax confirms its origins. They give each other meaning, even as lock and key. . . . Man is nature's beginning to be self-conscious."

The past 50 years have provided the evidence which Sherrington lacked to support his adventurous thesis.

WHAT IS LIFE? Biologists probably find this harder to answer now than did their predecessors of 200 years ago, when, despite the absence of a unifying theory of biology, at least there was no doubt as to what was "alive" and what was not. Living things appeared to be imbued with a mysterious "Life Force" or "Vital Spirit" which, though hard to define, was easy to identify. Modern developments in organic chemistry and molecular biology have gradually eroded the barrier separating the physical sciences from the so-called "life sciences". The "Vital Spirit" has been snuffed out by the cold water of science.

> "A speck of material which is said to 'live', while the vast majority of specks of material are said to be lifeless? Has it some particular element of matter in it which those other specks have not? No; that is not the key. The elements of matter in the living cell are among the very commonest of those spread broadcast in material which does not 'live', in soil, rock, air and water. . . .
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> The difference is not one of ultimate nature but of scheme and degree of complexity. 'Living' becomes a name for certain complexes of them, arrangements of which it may be said that they are organized integratively, i.e. to form a solidarity, an individual."

In a classic experiment in the 1950s, the American researcher Stanley Miller showed that a wide variety of amino-acids could be synthesised in the laboratory. Miller attempted to reproduce the conditions of the so-called "primeval soup" as accurately as possible in specially constructed flasks. He then subjected this rich broth to ultraviolet light and electric sparks, simulating electric storms and

[1] Bertrand Russell, *The Analysis of Mind* (1921).
[2] Charles Sherrington, *Man on his Nature* (1940, second ed., Cambridge University Press, 1951; still available).

unfiltered sunlight. The results demonstrated that complex organic compounds could be produced out of simple substances in conditions similar to those on the earth's surface three to four billion years ago. More recently, Juan Oro and A. P. Kimball found that the building blocks of DNA could be produced by a similar process.

The emergence of such complex chemicals from the primeval soup seems fairly easy to accept. Much harder, for most of us, is the notion that these substances "evolved" by the action of physical forces on chemical composition, to produce the abundance of living things we now see. This is a conceptual leap that we find difficult to make. To Sherrington, however, the idea is far from preposterous.

> "There was a stage in the dark backward and abysm of time when our planet's side was not as yet a place possible for the life now around us. A stage ensued, however, when things would by a bare margin just permit the type of energy-system we speak of as living. Slender though that chance, it was, so to say, seized. Life appeared. Perhaps in some small runnel of tidal mud or frothy ooze. . . . Mere mechanism and yet charged with germinating reason."

Recent authors have been more audacious than Sherrington. The Oxford physical chemist Peter Atkins, for example, has stated that life becomes inevitable once the appropriate conditions occur. In his view, the action of sun, wind and sea on the chemistry of the primeval soup will lead to "biology"; and this isn't just probable, it is inescapable.

OUT OF THE MELTING POT, then, comes DNA, a substance with the remarkable ability of replicating itself. The primeval soup becomes populated with copies of DNA, some of which are more stable than others. Robust copies survive, while fragile ones disintegrate. Random transcription errors occur, most of which are disadvantageous but some of which improve the chances of survival of the replicators carrying them. Errors conferring an advantage become more numerous in the gene pool, and over aeons life becomes increasingly varied and increasingly complex.

What is the purpose of it all? There is none. "Life's story has been the unfolding of germinal powers of the planet." Life erupts out of a chemical sea simply because physical conditions allow (demand?) it. Once life exists, the application of the laws of physics seems somehow more sinister. What appears innocuous when applied to soap-bubbles or salt-crystals seems savage when applied to song-birds.

> "It was a strange misapprehension on the part of Rousseau that the native state of Nature is a peace. Nature in the primeval African forest as observed by a naturalist of today is found to present an appearance 'sinister, hostile and horrible'. . . . Nature contains much which is hateful and much of pain. Much that 'spoils the singing of the nightingale'."

The concept of a struggle for existence had been central to biological theory since Darwin chanced upon the writings of Thomas Malthus in 1838. Actually the struggle for existence is more metaphorical than literal, and manifests itself in mathematical trends rather than physical combat. Put simply, it means that successful organisms will endure, and their offspring will be more numerous, while less successful organisms will become scarce. Traits which enhance the ability to survive will be inherited to a greater extent than traits which do not.

TO DARWIN and his immediate successors, the struggle had been between species, or at least between individual organisms. With the advent of a mathematical analysis of population genetics, the idea arose that evolution could be regarded as a change taking place within the "gene pool" of a species. The modern view has been summed up by E. O. Wilson in his *Sociobiology* (1975):

> "In a Darwinist sense the oganism does not live for itself. Its primary function is not even to reproduce other organisms; it reproduces genes, and it serves as their temporary carrier. Each organism generated by sexual reproduction is a unique, accidental subset of all the genes constituting the species. Natural selection is the process whereby certain genes gain representation in the following generations superior to that of other genes located at the same chromosome positions. . . . But the individual organism is only their vehicle, part of an elaborate device to preserve and spread them with the least possible biochemical perturbation. Samuel Butler's famous aphorism that the chicken is just the egg's way of making another egg has been modernised: the organism is just DNA's way of making more DNA."

Richard Dawkins's *The Selfish Gene* (1976) is perhaps the ultimate expression of this line of thought. Dawkins argues that bodies are the wrong level of evolutionary analysis and that all evolution is nothing but a struggle amongst genes. This is really a strict version of Darwinism in which all features are seen as adaptations, and bodies are just temporary containers for their selfish genes.

Many have raised the objection that this view of evolution is teleological. Dawkins is accused of attributing to genes characteristics that they clearly cannot have, such as selfishness, ruthlessness, and an ability to plan ahead and direct the course of evolution. This charge is based on a misconception. Dawkins repeatedly makes his true position known, and he warns against linguistic shortcuts:

> "Natural selection favours replicators which are good at building survival machines, genes which are skilled in the art of controlling embryonic development. In this, the replicators are no more conscious or purposeful than they ever were. Genes have no foresight. They do not plan ahead. Genes just are, some genes more so than others, and that is all there is to it. . . .
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> If we allow ourselves the licence of talking about genes as if they had conscious aims, always reassuring ourselves that we could translate our sloppy language back into respectable terms if we wanted to, we can ask the question, what is a single selfish gene trying to do? It is trying to get more numerous in the gene pool."

In the struggle for survival, organisms equipped with the ability to solve life's problems will tend to be more successful than those lacking such equipment. Genes coding for problem-solving abilities will become more numerous, and behavioural repertoires will become more complex. Thus, in retrospect, evolution appears to have "favoured" the development of intelligence. This retrospective judgment, though, should not be equated with a purpose in nature. Intelligence has evolved because it has been advantageous in local conditions at specific times. Like life itself, it is the product of "a contingent past, not the inevitable and predictable result of simple, timeless laws of nature".[3]

ON THE SURFACE, the Sherringtonian view of the evolution of mind has a passing resemblance to the poetic vision of Bergson or Teilhard de Chardin, in which evolution is the fundamental motion of the entire universe, a striving onwards and upwards towards consciousness. Teilhard, in particular, saw in noogenesis direct proof that evolution had a direction, and that that direction was towards cerebralisation. To the modern biologist too, the outstanding feature in the phylogenetic development of the nervous system is the cerebralisation of function—the gradual shifting forwards of ultimate control to the forebrain, a process reaching its greatest complexity in man. But to the biologist, that process is seen as the end-product of millions of random genetic mutations, each of which has provided a significant advantage at the right time and place.

The shibboleth which most acutely distinguishes the Sherringtonian view of mind from that of Bergson or Teilhard, however, is the concept of falsifiability. Science proceeds by generating and testing hypotheses. That which is not falsifiable is not science. Sherrington's image of mind erupting out of a chemical sea appeals to the voluptuary, mystical streak in all of us, but it does more than that. Sherrington constructed a model of the mind which is logically consistent, which is informed by a vigorous, ambitious and robust general theory—Darwin's theory of natural selection—and which is, at least in principle, falsifiable.

We can divide this explanation of mind into a "proximate cause" and an "ultimate cause". The ultimate cause of mind is natural selection. The proximate cause is the activity of the brain. Mind is the inevitable pouring forth of experience which results from the normal working of the intact human brain. It is this aspect of Sherrington's work which has received most support from recent research. Psychophysiology, that hybrid branch of science that seeks physiological correlates of psychological events, has made huge inroads into this "inner space" in the past ten years. The brain's notorious inaccessibility, encased in a rigid skull far from the probings of the experimenter, has now been circumvented by the ingenuity of the electronic engineer. New techniques of brain imaging allow the correlation between brain and mind to be mapped out in a way which was inconceivable to Sherrington or his predecessors. Dynamic studies of brain function allow the psychophysiologist to assert more confidently than ever that mind is a function of brain.

WITH REMARKABLE perspicacity, Sherrington reserves his final, and longest, chapter to a discussion of ethics and altruism. Within the past twenty years altruism has again become a source of interest within evolutionary biology; Richard Dawkins, for example, states that his *The Selfish Gene* is an examination of the biology of altruism and selfishness. But while most professional biologists have been content to address the question "How did altruism arise?", Sherrington was more concerned with the problem of "What can we do with it?".

> "Nature is a scene of interaction, and between living things interaction can be co-operation or conflict. Nature exhibits such co-operation but she is burdened with conflict like a nightmare. Beauties it presents, joys it contains, but a blight of suffering infests it."

As an example of cooperation Sherrington cites "the fairylike visiting acquaintance between the planet's population of insects and its population of flowers". As an example of conflict, he describes at some length the malaria-causing parasite *plasmodium*:

> "This parasitic animal scourges with misery and death entire regions of Earth's surface which might but for it be happy places. A poet who had seen much of it called it 'million murdering', and that is true. Its life is the destroying of other lives, and it infects nearly one-third of Earth's population. It is a product of evolution. Evolution has adapted it, complexly, delicately and effectively to kill other lives."

These venomous specks, says Sherrington, are sustained at an immense cost of human suffering. But Nature recognises no lives of higher worth or of lower worth, because to her all lives are without worth:

> "Hume makes his character Philo inveigh against Nature 'pouring forth into her lap without discernment or parental care her maimed and abortive children'. But to the suggestion that Nature is immoral, today's reply is 'non-moral, not immoral'."

Man is a product of the same ghastly process. Worse, man is the product *par excellence*. He has achieved dominance because he has turned his mind to improving his defence, and defence lies mainly in attack. He has set himself deliberately to exterminate those lives which threaten his own. Now, partly emancipated from those ancient biological conditions, he has acquired "values" of right and wrong.

> "But ancient trends die hard. He himself is often still just one more agent of suffering to others. He must try to shed from his gene-complex some sub-human ingrained elements. The mill he has been through ground out its products in the main by retaining above all the interests of 'self'. He was a successful product of the process. The

[3] Stephen Jay Gould, *The Flamingo's Smile* (Penguin, 1986).

contradiction is that he is slowly drawing from life the inference that altruism, charity, is a duty incumbent upon thinking life. That an aim of conscious conduct must be the unselfish life."

THE HUMAN MIND is strangely placed on this planet, and excites in man a sense of loneliness. All other mind is inferior—and almost incompanionably so. Man's spirit yearns for company, and he seeks a Higher Being to meet his needs in this. But here Charles Sherrington departs from William James, the Gifford lecturer of 40 years previously. In a famous passage in his *The Varieties of Religious Experience*, James had stated that it was impossible to find in the driftings of the cosmic atoms anything but a kind of aimless weather, doing and undoing, achieving no proper history and leaving no result. James had continued:

> "The bubbles on the foam which coats a stormy sea are floating episodes, made and unmade by the forces of the wind and water. Our private selves are like those bubbles—epiphenomena . . . their destinies weigh nothing and determine nothing in the world's irremediable currents of events."

To Sherrington, the arrival of man signalled the end of this chaos and randomness. Man has broken the code, has revealed the mystery of his own origins, and alone understands that he and nature are parts of one and the same. He has found the whole "more than a mere whirlpool motion without progress", and sees that he has been a part of its moving onwards. The ultimate achievement of humanity has been the recognition of suffering occurring external to itself, and reacting to it in such a way that that suffering becomes its own. This raises human life to a plane above other life, but, Sherrington adds, "it is in mankind an attainment not reached with broadcast equality".

To some these words may seem facile understatement, written as they were at the height of the Third *Reich*. But Sherrington is thinking of a biological time-scale, which is tantamount to a geological time-scale, not of historical time. "As the periods of the planet reckon, civilization itself is young".

> "If we accept the story behind us, the planet, which being blind never before had purpose, now is lent a purpose and—anthropism of anthropisms!—by man."

Man's discovery that he is nature become self-conscious allows him to rebel against the process which has enthroned him, and to experiment with his new-found "values" of right and wrong. The man of science, says Sherrington, is a fractional man, not a whole man, because his scope is to distinguish true from false, not right from wrong. Nevertheless, man is endowed with ethical principles and the scientist cannot escape the obligation of applying them.

> "Otherwise in a world of mishap his scientific knowledge and his ethical judgement become two idle wheels spinning without effect, whereas they have been evolved and survive each to give the other effect."

Man on his Nature is a paean to science, and hence a paean to the human mind and to the process which generated it. Sherrington ends by suggesting that man's next goal should be the construction of a natural religion, a system of beliefs rooted in the study of nature, but transcending this and including a system of values.

This idea is not new, and its precursors are to be found in the writings of Hobbes and in the natural philosophy of von Schelling. Sherrington, though, gives a new impetus to this world-picture, with his clear account of how man has sprung from the substance of the planet. The appeal for a moralistic rationalism has been echoed recently by Peter Medawar and Stanislav Andreski.[4] The main obstacle to the achievement of this ideal, as noted by Andreski, is that many people are temperamentally ill-adapted to the scientific world-picture, and need the emotional comforts derived from a belief in the supernatural. On the other hand, Sherrington's eloquency on the origin of mind, and on man's relationship to the planet, may contain theosophy sufficient for the most mystical amongst us.

[4] See especially ch. 7 of Peter Medawar, *The Limits of Science* (1984); Stanislav Andreski, "Religion, Science, & Morality", ENCOUNTER, May 1988.

The Zoo Question

The eagle wouldn't acknowledge my visit,
Stared straight ahead at nothing,
Like an old man suddenly remembering
A question from twenty years before
And seeing the answer at last, a mile away.

He had a lame wing according to his label,
Sat and ignored the young people
Saying strange things to him, absorbed
By that mouse moving, twenty yards off,
A simple answer to proud desire.

Lawrence Dugan