

that wear occurs only at points where molecular contact exists. The function of the film of lubricant is to prevent such contact—to provide a cushion between the metal surfaces thick enough to prevent the molecular attractions of one surface reaching across to the other. A high adhesion between the oil and the metal tends to prevent the squeezing out of the film, which accounts for the beneficial effect of certain additions to mineral oils.

Dr. F. P. Bowden referred to some recent experiments showing that the frictional heat developed on sliding can raise the surface temperature of metals sufficiently to cause melting at the points of contact. Measurements had provided direct evidence that the surface flow of metals in polishing is brought about by actual melting, and

it was suggested that under many conditions of sliding and rubbing, the high temperature and the melting of the surface are important factors in the wear of metals.

The method of wear testing devised by Dr. Brownson was criticised by a number of speakers in the discussion, mainly on the grounds that the conclusions derived from the test were not in agreement with the results of long practical experience of the relative merits of alloys employed for bearing purposes and of the value of the duplex microstructure. Examples were cited of results completely negated in practice. On the other hand, the test has proved of value with extreme pressure lubricants and is capable of giving reproducible results in the hands of other workers.

Obituary

Prof. C. Lloyd Morgan, F.R.S.

CONWY LLOYD MORGAN, who died at his house in Hastings on March 6, at the age of eighty-four years, was born in London on February 6, 1852, the second son of a solicitor, J. A. Morgan. On reaching boyhood, he was sent to the Royal Grammar School, Guildford, which was in those days an essentially classics school, with Dr. Merriman as headmaster, an Oxford scholar of considerable distinction. On leaving school, and with the view of taking up engineering as a profession, Lloyd Morgan proceeded to the Royal School of Mines, where he was Duke of Cornwall scholar, Murchison medallist and De la Beche medallist. Here in due time he gained his diploma as associate in mining and metallurgy.

But during the period of his professional training, the rector of Weybridge, where his parents were then living, induced Lloyd Morgan to read Berkeley's "Principles" and Hume's "Enquiry", chiefly as an initiation into the realm of philosophy. Indeed, under this guidance he began at length to wrestle with Spinoza, "quite the finest bit of coral", he was told, "for philosophic gums". Immediately after obtaining his diploma, he spent several months on a tour to North America and Brazil, during which time, partly through reading Darwin's "Voyage of a Naturalist", he became deeply interested in biological science. In fact, before setting out on this tour, he was fortunate enough to come under the influence of T. H. Huxley; and when, on one occasion, he told him of his interest in philosophy, Huxley remarked: "Whatever else you may do, keep that light burning. Only remember that biology has supplied a new and powerful illuminant". Accordingly, on returning to London, he followed Huxley's suggestion and took a course under him in biology at South Kensington, working also in his laboratory. A few encouraging words from

Huxley lent support to the conviction at which he had gradually arrived, that the borderland problems of life and mind afforded a promising plot for an effort at intensive cultivation under the spade work of careful observation.

The thought of engineering as a profession was consequently abandoned. Yet Lloyd Morgan had somehow to earn a living, and tried his hand at teaching. After occasional work in schools, he obtained in 1878 the post of lecturer (in physical science, English literature and constitutional history) at the Diocesan College, Rondebosch, near Cape Town. There he served for five years. Shortly after his return to England, he was appointed as lecturer in University College, Bristol, to carry on, for the rest of the session 1883-84, the work in geology and zoology relinquished by Prof. W. J. Sollas, who had been called to Trinity College, Dublin. At the close of that session, his appointment as lecturer was renewed; and in due course he became professor, Sir William Ramsay being at that time principal of the College. When Ramsay in 1887 accepted the chair of chemistry in University College, London, Lloyd Morgan succeeded him as principal of the Bristol College and continued to hold this office until 1909. In the capacity of principal he worked assiduously to place the College in such a position as to justify the grant of a university charter; and, when ultimately in 1910 the charter was obtained, it was generally recognised that it was largely through his persistent efforts. He accepted the position of first vice-chancellor of the new University, but only on the understanding that it was to be an interim appointment; and when, after three months, Sir Isambard Owen was chosen for the office, he relinquished it, and became the first occupant of the new chair of psychology and ethics. This chair he held until he retired in 1919, at the age of sixty-seven years.

Possessed from early life, as he himself has recorded, with an ineradicable *cacoethes scribendi*, Lloyd Morgan was a voluminous writer. During his Bristol period he published: "The Springs of Conduct; An Essay in Evolution", in 1885; "Animal Biology", in 1887; "Animal Life and Intelligence", in 1890; "Introduction to Comparative Psychology" and "Psychology for Teachers", in 1895; "Habit and Instinct", in 1896; "Animal Behaviour", in 1900; and "Instinct and Experience", in 1912. After his retirement, there appeared from his pen two volumes of Gifford Lectures, delivered in St. Andrews, entitled "Emergent Evolution", in 1923, and "Life, Mind and Spirit", in 1926; "Mind at the Crossways", in 1929; "The Animal Mind", in 1930; and "The Emergence of Novelty", in 1933. He was also a frequent contributor to NATURE, Mind and other periodicals, and was the author of several articles in the "Encyclopaedia Britannica".

As one of the borderland problems of life and mind, it was natural that Lloyd Morgan's early researches should be directed upon the facts of instinct. Soon after settling in Bristol, he undertook a prolonged series of experiments and observations on young chicks and ducklings hatched in an incubator with the object of ascertaining the relation of instinct to intelligence. As an outcome partly of these investigations, he reached the general conclusion that while instinct and intelligence are in the most intimate relationship throughout very nearly the whole range of animal behaviour, yet the original exercise of an instinct cannot be determined by intelligent consciousness. Instinctive behaviour comprises, then, those complex groups of co-ordinated acts which, though they contribute to experience, are, on their first occurrence, not dependent on individual experience. Such initial instinctive behaviour depends solely on how the nervous system has been built through heredity; and it is, he urged, the business of scientific interpretation to disentangle the factors that are prior to individual experience and those that result therefrom.

Later, Lloyd Morgan devoted much attention to the problems of colour vision. Acknowledging that there is a physical world of current events, existent in its own right, in so far as it is in nowise dependent upon being perceived by any finite mind, he yet resisted the view that colour has its being in that physical world. Colour as experienced is, he insisted, an indication or a sign of the presence of specific chemical changes in the retina and the choroid under advenient electromagnetic influence. It is there that colour signs have their genesis; it is thence that they are projicient on to the objects of vision. Colour, in other words, is the psychic sign correlated with certain specific events in the organism. In fact, secondary qualities generally may be said to be properties extrinsically real in relation to our persons—not only our minds but also our bodily organisation, as recipient of advenient influence and as the seat of intervenient processes and thus contributory to projicient reference.

It was doubtless largely through these and other allied biological researches that Lloyd Morgan was

led to the more ambitious project of attempting to build a philosophy on scientific foundations. The system of thought which he ultimately propounded was what he called a philosophy of evolution, but evolution as meaning the coming into existence of something in some sense new; and this something new, in a specialised sense, he labelled, adopting G. H. Lewes's term, "emergent", as contrasted with resultant. Resultant rearrangement, he allowed, runs through the whole process of physical Nature, and gives its own type of continuity; yet it affords no sufficient interpretation of atoms, or molecules, or crystals, because it disregards the supervenience of a new kind of substantial relatedness at each critical stage in the ascending course of events. Looking then at the world at large, we find (a) an array of physico-chemical events; (b) an array of vital events which occur only in organisms; and (c) an array of mental events which occur only in some organisms. The contention is that in vital events there is a new *kind of relatedness* which does not obtain at the lower level of physico-chemical events; and, in mental events, a further kind of relatedness which does not obtain in vital events as such. The chief bar to the acceptance of this contention is, it seemed to him, the acceptance, under the influence of a long tradition, of a radical dualism between the physical and the psychical. But he rejected that dualism, and maintained that there are no physical events, no integral systems of such events, that are not also psychical events and integral psychical systems. There is one evolution in both attributes—distinguishable, but nowise separable. Hence there are not two worlds—a physical world and a psychical world—but one world, psycho-physical throughout.

Lloyd Morgan accepted, then, fully and frankly, the most thoroughgoing naturalism in the field of science, which includes the psychical no less than the physical attribute of natural reality; and in that field he found a progressive supervenience of new kinds of relatedness in accordance with an orderly plan. But philosophy, he held, cannot rest content with mere naturalism. It requires something more, something of the nature of a relating and directive Activity of which the *de facto* relatedness and the observed changes of direction (with which science is concerned) are the manifestation; and it seemed to him that Causality (as distinguished from the naturalistic causation) is the universal operation of Spirit manifested everywhere and everywhen. He discerned in Nature one immanent Causality, of which the whole course of evolution affords diverse manifestations. Emergent evolution in the temporal world is, he contended, dependent upon the eternal non-emergent being of God.

To all those who had the privilege of knowing Lloyd Morgan, his distinguished personality with its innate courtesy, its sympathetic manner, and its clear, rational insight remains a precious memory of what a life devoted to science and philosophy may mean. Lucid, methodical and facile as a lecturer, he was regarded with genuine affection by his colleagues and students of earlier and later years.

G. DAWES HICKS.