crawl on a small ball in such a way that no light is reflected from the substrate. The snails, however, orientate themselves equally well when their eyes are shielded from direct light and the only light they can see is reflected from the substrate. Photopositive individuals orient themselves at right angles to the plane of polarization. Burdon-Jones and Charles believe that in either situation the snails orient themselves with respect to a pattern of light and shade, perhaps arising from the Fresnel laws of refraction of plane polarized light, and that the animals do not possess any special powers of analysis whereby they could discern the polarized light in another way.

Our knowledge of orientational behaviour in polarized light is as yet too scanty and insufficiently integrated to permit of a general resolution of the apparent contradictions, and in fact it is not at all certain that similar mechanisms operate in all situations where polarized light has been shown to produce orientational effects. Some suggestions might, however, be useful. One might distinguish between phototactic responses of animals which are correlated with the plane of polarization of light and the more complex perception and consequent utilization of polarization patterns in the blue sky as inferred for the bee by von Frisch. Indirect directional effects of overhead sources of polarized light striking certain structures in the natural or experimental environment or in the dioptric apparatus and resulting in objective brightness patterns might frequently provide a sufficient explanation for the orientational behaviour of animals whether they in fact possess retinal receptors with analysing properties or not. On the other hand, it is rather difficult to see how orientation with respect to small areas of blue sky could occur without

such receptors. However, in many situations brightness gradients and polarization patterns in various parts of the blue sky are associated, and bees might in fact orient themselves to the former. Furthermore, reflexion patterns caused by sunlight will often have their maximum brightness in the same azimuth as the Sun itself and the same applies to polarized light from a small area of sky reflected in a substrate. Thus the position of the Sun might be perceived by a bee directly or, when the Sun is invisible, its azimuth might be inferred from a brightness maximum in an area of the sky or a reflecting background. The reactions of *Littorina* in the different conditions described above conform with such an explanation and might perhaps be taken to support this speculation.

Another aspect of the orientation to polarized light might be mentioned finally, namely, its role in the life of the animals. It is probably safe to assume that many of the observed reactions are merely experimental artefacts. However, it is possible that, in other instances, orientation to sources of polarized light—however it works—may be of great ecological importance. Progress in this field will depend on the careful weighing of evidence from such diverse techniques as electron microscopy, electrophysiology, photometry and not least from observations of the animals concerned.

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OBITUARIES

Sir Ian Clunies-Ross, C.M.G.

SIR IAN CLUNIES-ROSS, chairman of the Commonwealth Scientific and Industrial Research Organization (Australia), died on June 20 in Melbourne, Victoria, in his sixty-first year. He was born at Bathurst, New South Wales, and educated at Newington College, Sydney. He graduated as bachelor of veterinary science from the University of Sydney in 1921 and was awarded the degree of doctor of veterinary science of that University in 1928. After graduation he was awarded a Walter and Eliza Hall Veterinary Research Fellowship and undertook postgraduate studies at the London School of Tropical Medicine and at the Molteno Institute, University of Cambridge. In 1928 he went to Japan for parasitological studies at the Institute of Infectious Diseases at Tokyo Imperial University.

In 1925 Clunies-Ross was appointed lecturer in parasitology in the University of Sydney, and in the following year Council for Scientific and Industrial Research parasitologist. When the C.S.I.R. McMaster Animal Health Laboratory was established in 1931 through the munificence of Sir Frederick McMaster, Clunies-Ross was appointed as the first officer-in-charge. He held this position until 1937, when he was appointed Australian representative, and later chairman, of the International Wool Secretariat in London.

Early in his career Clunies-Ross specialized in veterinary parasitology—a much-neglected subject in Australia at that time. He saw clearly its great economic significance, especially to the sheep and wool industry, and applied himself to it so effectively that he quickly became one of the world's leading scientists in that field. Although most of his work dealt with helminthiasis of sheep, his interest ranged widely among parasitological problems of other domestic animals and of man. He brought to all his work a broad outlook and a depth of scientific understanding which inspired his colleagues and immediately won the confidence of the livestock industries. Between 1923 and 1937 he published some sixty articles as sole author and a further fifteen as senior author; in addition, he was co-author of a text-book on the parasitic diseases of sheep.

Realizing at the outset that the clarification and definition of the multiple and diffuse problems of ovine helminthiasis were essential if effective means of therapy and prophylaxis were to be devised, he instigated widespread surveys of the incidence and distribution of the major worm parasites of sheep, and of the associated climatic and other factors which determined their clinical significance. Thus, for the first time a sound basis was laid for studies on epidemiology, host-parasite relationships and selective anthelmintic treatment. He and his colleagues fol-

lowed up with great vigour and enthusiasm the advantage this clearer understanding of the problem gave them, and progress flowed from it rapidly.

Among his many outstanding contributions, Clunies-Ross was the first to record the effect of copper sulphate on closure of the oesophageal groove in sheep. This opened up a new approach to anthelmintic treatment. It was he who, by well-planned field trials, removed the fears of graziers that more intensive stocking of sheep on improved pastures would result in heavy losses from parasitism. This led him to investigate the effects of improved pastures on the quantity and quality of wool production. It was widely held that the well-being of the Merino and the quality of its wool depended on extensive, highly selective grazing, and that intensive grazing on the narrow range of species in sown pastures would result in coarse and inferior fleeces. Clunies-Ross clearly demonstrated that not only can Merino sheep tolerate intensive grazing but also that they respond to the higher nutritional levels of sown pastures by producing much heavier fleeces with little change in fibre diameter.

Clunies-Ross was an inspiring research leader. He had the capacity to see problems clearly, to ask the crucial questions and to find ways of answering them effectively by laboratory or field experimentation. His interest in veterinary research, however, and his choice of problems was always greatly influenced by his genuine love of animals. This is well exemplified by the work in tick-paralysis of dogs, which was one of his most original and successful investigations. He was then living in a part of Sydney where many hundreds of pet dogs died annually from the disease. He was so moved by their suffering and by the distress of their owners that, in addition to all his other work, he took it upon himself to study this problem also. Within three years he elucidated the epidemiology of the disease, traced its cause to a toxic factor in the salivary gland of the engorging female tick (*Ixodes holocyclus*), and prepared an antitoxic serum of high curative value. This was typical of him; his interest was not in gaining new knowledge for its own sake but for the use which could be made of it. Having once gained it, he used to the full his great gifts as a writer and public speaker to explain its significance to all who could apply it with advantage.

Clunies-Ross's active personal research had to be laid aside when he joined the International Wool Secretariat. Although he was appointed professor of veterinary science in the University of Sydney in 1940, he had little opportunity for scientific work, as he was called upon to serve during the war years as director of scientific personnel in the Commonwealth Directorate of Manpower and with the Department of War Organization of Industry as an adviser on the pastoral industry. The War interrupted his scientific career, but it gave him opportunities to use his unique knowledge of Australian agriculture and his outstanding powers as a speaker and publicist to encourage and assist the remarkable growth of science and education in Australia during the years which followed. In 1946 he joined the Executive Committee of the Council for Scientific and Industrial Research, and in 1949, when the Council was reorganized as the Commonwealth Scientific and Industrial Research Organization, Clunies-Ross became its first chairman. He continued to maintain his close interest in the wool industry and played a large part in procuring the funds which enabled C.S.I.R.O. to build up a major effort in sheep and

wool research and wool textile research. Throughout the pastoral industries his many friends had confidence in his judgment, and with their help and with the backing of the Government he had the satisfaction of seeing, towards the end of his life, a large body of scientists working enthusiastically on many problems of great national importance. The major contributions which C.S.I.R.O. has made to the agricultural development of Australia have been largely due to his outstanding and inspiring leadership.

Clunies-Ross had many interests outside his scientific work. The field of education was one in which he played a big part, and he was outspoken on the need for retaining breadth and liberalism in education. He stressed repeatedly the dangers inherent in the increasing specialization of modern scientific and technological careers. He played a large part in persuading the Government to set up the Murray Committee on Australian universities and made a major contribution to its outstanding report. He was deputy chancellor of the University of Melbourne and a member of the Council of the Australian National University. For many years he was active in the work of the Australian Institute of International Affairs and was well known as a public speaker on foreign affairs. He was particularly interested in the relations between Australia and its northern neighbours. As chairman of the International House of the University of Melbourne, a hall of residence in which Australian and overseas students live together, he was instrumental in making the idea a reality.

Clunies-Ross was made C.M.G. in 1954, and in the same year he was created a knight bachelor. He was a foundation Fellow of the Australian Academy of Science. He was awarded the honorary degrees of doctor of laws by the University of Melbourne, and doctor of science by the Universities of New England and Adelaide. He is survived by Lady Clunies-Ross, three sons and one daughter.

At the memorial service held in Scots Church, Melbourne, shortly after his death, Prof. J. D. McCaughey, Master of Ormond College, University of Melbourne, made a fitting tribute to his memory. He expressed in these simple terms the feelings of his many friends and colleagues throughout Australia and overseas: "But in and through these achievements, it is Ian Clunies-Ross the man whom we remember with admiration, with respect and with affection to-day. His capacity for work must have been enormous: to die at sixty is young, yet into those years was packed an astonishing variety and depth of interests. He lived a heavily committed life; yet, I suppose, that many of us in this Church think of him, with gratitude, as one who had time for friendship. He accepted us with a smile. It must have been given to few who have lived so fully, yet to be loved by so many".

F. W. G. WHITE
D. A. GILL

Dr. V. Korenchevsky

DR. V. KORENCHEVSKY, who died suddenly on July 9, was born in 1880 in Russia and graduated from the Imperial Military Medical Academy in St. Petersburg in 1903. After military service in Manchuria during the Russo-Japanese War, he worked in Metchnikoff's department at the Pasteur Institute in Paris and in Pavlov's laboratory in St. Petersburg.