

The next period (1675-99) saw the publication of the "Principia" (1687). Enough is said of the contents of this great work to give the reader some idea of what it achieved.

In 1699 Newton was appointed Master of the Mint, "his periods of intense devotion to science at an end". The story of the remaining years of his life is followed, in the last chapter, by an understanding and sympathetic estimate of his character.

The prologue rather suggests that this book is intended for "the young"; certainly Newton's work is presented shorn of all, or nearly all, its difficulties. It is, however, as a valuable and scholarly introduction, not only to Newton and his work, but also to the whole of this important epoch in the history of science, that the book is recommended to young and not-so-young alike.

N. H. DE V. HEATHCOTE

ANIMAL BEHAVIOUR

Wild Animals in Captivity

By Dr. D. Hediger. Translated by G. Sirecom. Pp. ix+207+17 plates. (London: Butterworths Scientific Publications, Ltd., 1950.) 35s. net.

THE study of the behaviour of wild animals in captivity has hitherto received comparatively little attention, and Dr. D. Hediger's "Wildtiere in Gefangenschaft", published in 1942, was the first attempt by a trained zoologist to collect information on the subject. An English translation of this work, revised and brought up to date, has now appeared and will be welcomed by all interested in animal behaviour. The author, director of the Basle Zoological Gardens, has had a wide experience of animals both in captivity and in the wild, to which is added a knowledge of animal psychology. The result is an authoritative treatise which may help to correct some of the mistaken notions concerning animals in captivity, usually the result of an anthropomorphic approach to the subject.

A proper appreciation and understanding of life in captivity must obviously be based on a careful study of life in the free state, yet in the case of most species this information is very incomplete, especially in such important details as territorial requirements. It is generally assumed that in Nature animals enjoy unlimited freedom of movement; but this is far from the truth, since the majority of them are not only restricted to certain geographical areas but also to particular habitats, and in addition their distribution is dependent on relations with other occupants of the territory. The author shows that by attention to such details it is usually possible, even within the restricted area of a zoological garden, to meet the physiological and psychological requirements of most species.

The quality of the environment is shown to be of the greatest importance for the welfare of animals, and many interesting examples are given of the requirements of different species in captivity. These may be fundamentally different from the human idea of comfort, as, for example, in the case of the loris, *Nycticebus coucang*, which prefers its cage to be soaked with its own urine. Apart from the physical surroundings, the biological environment is of equal importance, for some animals prefer to live in close bodily contact with other individuals, not necessarily of the same species. On the other hand, some animals prefer to be at some individual distance, and do not tolerate physical contact except during reproduction.

Special attention is devoted to the problem of food and the necessity of providing a reasonably varied diet, together with the timing and method of food presentation. Another section is devoted to breeding, and details are given of the author's method of breeding hares by the use of a double cage whereby the animals are changed over every two days, thus ensuring that their quarters are kept thoroughly clean. This is necessary since young hares are particularly susceptible to coccidiosis and become reinfected if they remain in one place for more than two days. The relationship of animals with man forms the subject of an interesting chapter in which the question of the training of animals is discussed; this is considered by the author to correspond in some respects with sport and athletics in man.

Dr. Hediger's book will be invaluable to all interested in the proper care of animals in captivity and their behaviour.

EDWARD HINDLE

RETINAL RESPONSE

Optique physiologique

Tome 2: Lumière et couleurs. Par Prof. Yves Le Grand. Pp. 490. (Paris: Éditions de la *Revue d'optique théorique et instrumentale*, 1949.) 1600 francs.

THE first volume of Prof. Y. Le Grand's treatise on physiological optics dealt with the eye as an optical instrument; the eye as a receptor of radiant energy forms the theme of this second volume. The subject-matter includes the appreciation of brightness and colour, the spectral luminosity functions, colour-matching and the principles of colorimetry, brightness and colour thresholds, visual adaptation, the photochemistry and electrophysiology of the retina, theories of colour vision and colour anomalies—the whole being treated from the physicist's point of view, that is to say, attention being concentrated on results and conceptions expressible in quantitative terms.

The author's aim has been to produce a book which, while contributing to the subject, should also have instructional value. He has, in fact, included a number of problems (with their solutions) which bring out further implications or applications of the principles discussed. This feature is of a piece with the critical approach to the subject, which is in evidence throughout—and how much the more speculative developments of this subject need a critical approach. The result, in my opinion, is an account of the highest excellence—lucid, sound, terse, with an occasional half-humorous, half-sardonic comment to provide a touch of seasoning. Prof. Le Grand appears to have no particular theoretical axe to grind, and his analysis of current theoretical trends, while perhaps unlikely to satisfy completely the respective protagonists, should prove invaluable to the student.

In a very few places conclusions are reported which are no longer accepted, for example, the estimate of ten chromophore groups to a visual purple molecule (p. 366). But my main complaint—a minor one—concerns the references; although some 160 of these are listed in full at the end of the book, there are many more in the text identified only by a name and year. It would be helpful if the full references, at least for the more recent papers, could be given in a future edition, or perhaps as an addendum to the third volume which Prof. Le Grand has promised us.

W. S. STILES