more generally documented. Nevertheless, for any one interested in parent-offspring and sibling correlations for intelligence this body of data will be of extreme interest, and it is clear that many people will be greatly indebted to the authors for this first-class compilation so frankly presented.

P. L. BROADHURST.

INNATE AND LEARNED

EVOLUTION AND MODIFICATION OF BEHAVIOUR. K. Lorenz. Methuen, London, 1966. Pp. 122+vi. 25s.

Lorenz says he wrote this book "to prevent the discrediting of a concept . . . indispensable to an ethological approach. This concept is that of the innate." The ethological approach in zoology undoubtedly has had great influence on those concerned with behavioural work on animals since World War II. This essentially continental approach has now taken firm root in this country and produced some distinguished experimental work: its influence in America has been somewhat less widespread but is nevertheless considerable. Previously comparative psychologists were among the few concerned with the analysis of animal behaviour.

To support his aim Lorenz critically examines the history of recent discussions of the ethological concept of the innate. He takes the distinguished Canadian psychologist Hebb to task for his insistence that the dichotomy between what is innate and what is learned is a false one in that the two can only be distinguished by mutual exclusion. The spectacle of the two most recently elected Fellows of the Royal Society, thus honoured for their contributions to behavioural work, so contentiously engaged together dramatically highlights the divergencies between the two major approaches in this area, that of the ethologist and the animal psychologist.

Lorenz bases himself on a Darwinian position which, despite his characteristic strictures on psychologists who work with animals in the laboratory, is one which, I imagine, most animal psychologists would today be content to share. Lorenz clearly views learning as an individual recapitulation of the evolutionary process. This he tellingly calls "trial and success (not error)"—the process of selective adaptation which is now, I suppose, universally accepted as underlying evolutionary change. The unamended phrase, of course, is that of Thorndike, one of the pioneers of animal psychology whose studies of animal learning form part of that large body of work begun at the turn of the century in the United States and carried out continuously thereafter and which ethologists so frequently ignore in discussing the development of their own interest in innate behaviour which dates from more recent times. He is willing to correct the record by admitting that older ethologists did in fact fall into the error of minimising the role of learning, especially their neglect of the selective pressures attributable to the reinforcement principle. This principle, so central to much of learning theory, was first emphasised by Pavlov and was developed and extended by his American successors, such as Hull. But, in contradistinction to many modern ethologists, Lorenz persists in regarding some aspect of response in the organism as innately given and not subject to individual adaptation as a result of experience. Thus he appears to retain the view, which he characterises as being that of the older ethologists, that there may be "self-contained units into which learning does not enter".

A goodly proportion of this short book is devoted to the significance of the deprivation experiment. This type of experiment is one in which an organism is reared in conditions which do not permit of it individually experiencing environmental conditions which could account for behaviour which it later displays, on the basis of learnt responses based on that experience. Thus, to take a simple case, if a bird is reared in the absence of any experience of a nest or of members of its own species but later, at the appropriate time, responds to nest-building material by constructing a typical nest then this would seem to exclude the possibility that such behaviour had a basis founded on individual learning. The limitations and necessary conditions attaching to this type of experiment are carefully explored and clearly explained.

This then, is the basis for the title of the book, which at first sight promises so much but which deals with one particular viewpoint in biology. No mention is made of the possibility, now extant, of a more fine-grain analysis of what is innate and what is learnt—an analysis which largely, or so it seems to this reviewer, supersedes that which is of such concern to Lorenz to defend. Analytical techniques now exist for assessing with some accuracy the relative importance of the innate and the environmental contributions to observed behaviour—that is, the pre-conceptual and hence genetically programmed as opposed to the post-conceptual and hence subject to individual adaptation. Moreover, biometrical genetics offers the workers concerned with behavioural phenotypes an experimental methodology and the analytical tools for the establishment of the precise genetical architecture of a population. Knowing the type of genetical architecture which can result from artificial, as opposed to natural, selection, enables us to deduce with some confidence the type of selection pressures to which the organisms investigated must have been subjected to in the course of evolution. Moreover, systematic variation in the environment of the phenotype in which the organism develops or in which it is measured, such as might well occur in a deprivation experiment, enables us to apply some degree of experimental verification to the speculations about past evolutionary pressures to which our knowledge of genetical architecture might lead us. In this way a hastening of the already developing synthesis of the two approaches via the learned and the innate, characteristic of psychologists and ethologists respectively, may be achieved by bringing in the findings of modern genetics to hold the ring.

It is in this context that the valuable insights presented by Lorenz about the evolution of behaviour, and the hypothesis regarding which he offers it can be tested. For example, he speculates and argues cogently a selective advantage for a species lies in some aspects of its response repertoire being resistant to environmental modification, that is, they should in the main be mediated by dominant genes. Such an hypothesis is subject to experimental test, and it is to be hoped that growing familiarity with psychogenetical techniques will enable workers to exploit such possibilities by mounting the requisite hybridisation experiments, either in the laboratory or in the field, in greater numbers in the future.

P. L. BROADHURST.

THE HOW AND WHY OF EVOLUTION.

PROCESSES OF ORGANIC EVOLUTION. G. Ledyard Stebbins. Prentice Hall, New Jersey, 1966. Pp. 191. 20s.

This book is a short, easy to read introduction to modern views on