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## BOOK REVIEW

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**The Development of Brain and Behaviour in the Chicken**, by Lesley J. Rogers. CAB International, Wallingford, U.K., 1995, 288 pp. £45 (US\$77.50)\*.

This is a timely and valuable book which provides an accessible, scholarly and thorough account of research in the complex area of brain and behaviour development in the chicken. It also serves to deliver a number of important take-home messages. Firstly, for example, by juxtaposing behavioural and neurobiological research in the chicken with that in other birds and in mammals, it clearly demonstrates the value of the domestic chick as a model animal. Secondly, by highlighting the complex interactions between environmental, experiential, genetic and hormonal factors in the developing chick it illustrates the benefits of a multi-disciplinary approach. Thirdly, it identifies some of the welfare problems faced by chickens and presents a compelling argument that increased understanding of their cognitive abilities is crucial for an informed improvement of wellbeing and performance.

Chapter 1 discusses the development of brain and behaviour in the embryo. It is packed with important information and it will undoubtedly be required reading for all those interested in the time course of developmental changes in the sensory and endocrine systems as well as in general pre-hatch behaviour. The chronological chart (Table 1.1.) is particularly useful. Like the rest of the chapter, the information is presented in such a way as to be easily assimilated, even by someone with only a rudimentary knowledge of the central nervous system. By presenting several cases of seemingly

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inconsistent data, Professor Rogers also rightly sounds a cautionary note in pointing out that stimulus saliency and the type of measurement made are often influential variables.

Chapter 2 describes some of the primary external variables (e.g. light, sound, touch) influencing embryonic development, their interaction with internal factors (such as the circulating levels of sex hormones), the role of communication with the hen and between embryos, and the important intermodality effects of sensory stimulation. Attention is also drawn to the possible effects of olfactory stimulation and of variations in atmospheric pressure.

The many variables influencing early learning and the development of selected behavioural systems are described in Chapter 3. Firstly, it covers imprinting, both filial and sexual, and reviews the evidence for the emergence of predispositions and for the existence of sensitive periods. This section also discusses social recognition and the formation of social attachments. The appearance of fear behaviour is then discussed in terms of maturation, imprinting and the recognition of novelty, early experience, and the social condition. The next section reviews the visual, olfactory and gustatory mechanisms involved in recognizing food and learning to feed as well as in the development of food preferences. Rogers then disputes early claims that rank order does not develop until chicks are several weeks old. By assessing intergroup competition for desirable resources rather than using the more traditional measure of aggressive pecking, she shows that social hierarchies exist even in the first week of life. Data on sleep and on cycles of behaviour are presented in the closing sections.

An intriguing and scholarly account of the development of the brain after hatching is presented in Chapter 4. It describes: the asymmetrical development of the forebrain hemispheres and the different behaviours controlled by each hemisphere; neurochemistry and neural plasticity; the cellular and molecular correlates of imprinting and memory formation; the routes of communication between the two hemispheres; and the maturation of synapses.

Chapter 5 discusses the behavioural transitions that occur during the first two or three weeks after hatching in terms of shifting hemispheric dominance. Some of the behaviour systems covered include: Thermoregulation, exploration, fear, feeding, attention, attack and copulation. This chapter also makes the important points that hemispheric dominance is sensitive to differences in age, gender and environmental context.

There is something of interest for all readers in Chapter 6 but it

will be particularly useful for comparative psychologists and physiologists. It begins by reminding us that although altricial species hatch at a more immature stage than precocial ones, like the chick, they follow the same general programme of development. It goes on to discuss species differences in the size of various brain structures and to relate this to their lifestyles. Parallels as well as distinctions are then drawn between hemispheric lateralization and behavioural function in a number of avian and mammalian species. Rogers closes with a compelling argument that the development of lateralization in the brain reflects multifactorial rather than unitary influences.

The seventh and final chapter reviews recent research on the cognitive abilities of birds and poses the intriguing and hugely important question "Can a brain be domesticated?" It addresses this question in terms of the chicken's long history of domestication and the demands placed upon it by the environmental and economic constraints of intensive farming systems. I would personally have enjoyed seeing an expanded chapter which placed greater emphasis on relating the wealth of information presented earlier to specific issues of poultry welfare and productivity. However, I accept that this may not be the most appropriate forum. Furthermore, Rogers does reach the telling and thought-provoking conclusion that even vastly improved intensive systems are unlikely to meet the cognitive demands of the hitherto underestimated chicken brain.

In conclusion, this is a handsome and well produced book; the quality of print, photographs and line drawings is excellent. The style of writing, the provision of summaries and concluding remarks for each chapter, and the frequent use of subheadings make the contents easy to follow and digest, despite the complexity of the subject. It will be a valuable addition to the shelves of researchers, teachers and students of animal behaviour, neurobiology, comparative and experimental psychology, poultry science, and animal welfare. Furthermore, not only is the book affordable but it also represents extremely good value for money. I enjoyed it immensely, I expect to dip into it frequently and I cannot recommend it too highly.