

ing for readers of this journal is Table 23, in which Eisenberg presents correlations (non-statistical) between body size, dimorphism (adornment, genitalia), and behaviour (forms of dominance, spacing between groups, social structure and adult relationships) for select social carnivores. In the last chapter (16) of this part, Eisenberg discusses trends in the adaptation and distribution of the Mammalia.

'Macrophysiology and Adaptation' are considered in part 3. Classical zoological concepts are applied to Mammalia. Chapter 17 covers the relationships between mammalian size and metabolic rate and metabolic rate and reproduction. Other topics considered in this part include the influence of body size on life history, body weight and home range relationships, relative sizes of mammalian brains (encephalization quotients), reproduction and development, and reproduction and life-history strategies. The available information suggests that low encephalization quotients tend to be correlated with preprogramming of information, specialization in one or two sensory modalities, passive anti-predator strategies, locomotion in two dimensions, minimum parental care, and utilization of a ubiquitous food source. Higher encephalization quotients tend to be associated with a contrasting suite of characters including information storage and retrieval based more on individual experience, active anti-predator strategies, long period of life spent in learning situations, rich but dispersed food resources, long potential life-span, late sexual maturation, and an extreme interoparous reproductive strategy. In chapter 22 Eisenberg discusses various aspects of reproduction and development. He also considers factors favouring the production of precocial young, and advantages and disadvantages of producing altricial infants.

The fourth and last part of this book is titled 'Behavior as a Subject for Study'. After a brief introduction in which some historical facts are presented, Eisenberg discusses the genetic basis for behaviour patterns, biological rhythms and the temporal patterning of behaviour, the description and classification of behavioural elements common to generalized terrestrial mammals, and interaction systems of generalized mammals.

Reproductive failure, social pathology and infanticide are considered in chapter 30. Infanticide, like other 'hot topics', has received both solid and superficial study. Eisenberg asks the simple questions: is infanticide adaptive and has it in fact been selected for? A typically careful analysis of the available information leads him to conclude that the occurrence of infanticide is associated with special demographic circumstances (small home ranges, large groups, low predation pressure), and that infanticide per se may be the outcome of selection for other traits, including attacking smaller conspecifics and non-kin.

The next three chapters deal specifically with social organization. Eisenberg makes the important point that social structure is not static, and that even if we recognize the existence of variability, normative (modal) social organizations can still be defined. Inter- and intraspecific comparisons of social structures will undoubtedly yield useful information.

Eisenberg's next task is to classify mammalian social organizations. He considers four different behavioural systems (mating, rearing, foraging and refuging) and the degree of sociality shown within each. Eleven mating patterns are recognized along with 10 rearing strategies, eight foraging units, and five refuging systems. Detailed summary tables present correlations (non-statistical)

between social systems and dimorphism for Monotremes, Marsupials, and Eutherians (59 species). Some general trends are: 82% of the species compared are polygynous, whereas 12% show obligate monogamy; in 12% of the species, the female receives some form of aid in rearing young from the male or older offspring or relatives; monogamous extended families display the clearest examples of cooperative rearing and food-sharing.

Finally, Eisenberg considers the selective forces producing different grades of sociality. Figure 156 nicely summarizes previous arguments concerning the evolution of complex societies. Basically, '... when one does find a complex interdependent social unit in the class Mammalia, the attributes of high encephalization quotient, kin selection, mutualism, interdependency and participation of siblings in the care of younger siblings all correlate ...' (page 442).

The detailed appendices that follow the text are gold-mines of information. There is also a glossary and a bibliography of over 1700 entries.

This truly is a fine book. No single review could do it justice; read it! *The Mammalian Radiations* would be suitable for anyone with a basic background in biology. We should thank John Eisenberg for taking the time to write this book. I am certain that this volume will be praised for decades to come.

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Comparative Psychology: An Evolutionary Analysis of Animal Behavior. Edited by M. RAY DENNY. New York, Chichester, Brisbane, Toronto: John Wiley (1980). Pp. 496. Price \$20.95.

This multi-authored introductory text, appropriate to the third and fourth year undergraduates for whom it is intended, provides an appealing first look at the area of comparative psychology/animal behaviour for students with some background in animal learning.

The volume consists of 22 self-contained chapters divided among three sections: 'An evolutionary and ecological perspective' (6 chapters), 'A comparative analysis' (8 chapters), and 'Some major classes of behavior' (7 chapters). The last of these major sections is the most congruent with one's expectations of an introductory text, providing good to excellent overviews of sexual, parental, scent-marking, anti-predator, feeding, and body care behaviours.

Those using this book in the classroom will probably have some difficulty with the first section. There is no systematic treatment of ethological theory or methods, sociobiology, foraging theory, or systematics. These topics are not omitted from the text — most are touched upon briefly in one or more chapters — but those seeking traditional treatments, both of these topics and a variety of others (ontogeny, motivation, aggression, etc.), must look elsewhere. Chapters in this section on domestication and migration, though both excellent, might well have appeared in sections two and three respectively, to provide additional room for discussion of more general issues at the outset.

Section two provides the text with much of its individuality, introducing a number of themes unusual in

introductions to the field. As one might expect from the title, there is an emphasis on phyletic diversity in functionally analogous patterns of behaviour and on the contribution of laboratory studies within the psychological tradition to the understanding of animal behaviour. Less expected is the generally artful blending of this material with ethological and ecological studies, the focus on application of research findings to real-world problems, and the recurring theme of the identification of research problems and the development of research programs. Two chapters in this section are unique and would reward any reader's attention. Tortora's discussion of animal clinical psychology is an insightful blend of ethology, animal learning, and clinical psychology. This chapter totally reversed my uninformed preconception that animal therapy was a subject better suited to presentation on late-night TV talk shows than in the classroom. Mountjoy's history of comparative psychology is a charming, eye-opening introduction to pre-Darwinian knowledge of animal behaviour.

Those looking for a new undergraduate text will find both strengths and weaknesses in the present volume. While both clarity of exposition and thoughtful expertise characterize the majority of chapters, there is no mention of many topics which I would want students to be aware of after a first course. I particularly missed material on circadian rhythms, bird-song learning, and the work of Lehrman and of Roeder. Further, I found it a bit odd that, for example, students would come away from an introduction to animal behaviour knowing much about Langstroth's work on the construction of artificial bee hives, but almost nothing of von Frisch's work on bee language, much about Frederick II's studies of birds but very little of Tinbergen's or Lorenz's work in the area.

While this volume may not become a standard text, it serves useful functions both by suggesting a broadening of the range of topics treated in introductions to the area and by demonstrating how successfully comparative-psychological, ethological, and ecological approaches can be integrated in introductory discussions of a range of topics. The book would prove useful to those prepared to fill its many lacunae with supplementary readings and appropriate lectures.

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The Nature of the Beast: Are Animals Moral? By STEPHEN R. L. CLARK. Oxford and New York: Oxford University Press (1982). Pp. vii + 127. Price £7.95.

How is it that we sometimes manage to be good? Perhaps we never do, and what seems to be altruism is but selfishness disguised. Or perhaps though naturally bad we may yet be saved by grace. Or again: perhaps we are good by nature.

It is in the context of this Aristotelian view that the question, 'Are Animals Moral', may arise. For if we are good by nature, it is at least possible that this is an aspect of our nature that we share with some other animals. The question is topical, for the evolution of 'altruism' is a central issue in sociobiology. This is not, of course, quite the altruism of everyday usage. Fitness is not the only good we aspire to, so acts that increase the fitness of others at the expense of our own are not the only altruistic acts, and are sometimes not altruistic acts at all.

And altruism is a matter of intention as well as outcome. Nonetheless, sociobiology has made it clear that altruistic motives in human beings could have evolved by natural selection—a possibility that a cruder conception of evolution might seem to proscribe—and there is no a priori reason why they should not also have arisen in other species. Two kinds of question then arise; one concerns how animals behave, and what structure of motives they have; the other concerns criteria for describing something as moral. This, then, is Dr Clark's concern: with the 'morals of nature', the 'morals, or pseudo-morals or quasi-morals': the 'impulses and inhibitions, learned and instinctual, that seem to play the part in beasts that morals play in us'.

To attribute to animals anything comparable to our moral motives entails at least that they be conscious, free and able to distinguish between themselves and others. Dr Clark begins with a general case for an 'Aristotelian' science. This is characterized as a science that has room for functions and for goals as well as for causes, and as one that depends primarily on careful observation of the natural world, rather than on 'putting Nature to the question', in Francis Bacon's chilling phrase. Ethologists will feel at home here. Nor will there be much dissent from the view that some animals, at least, can properly be described as angry, or frightened, or as having purposes: terms that can refer to conscious organisms only. As regards freedom, there is an obvious sense in which some animals, like some humans, are free (while others are not, as battery pigs know to their cost). But the sense relevant here is the one in which freedom contrasts with being 'determined'. In the human case, the argument against determinism is that there is no strong reason to believe that it is true, and that determinist concepts conflict fundamentally with those concepts of choice and responsibility that we all in fact find indispensable in dealing with human affairs. We do not generally use such concepts of animals, and if we do we could well enough manage not to, so the second part of the case does not apply here: the first remains. The later chapters of the book deal in detail with sexuality, parenthood, territory and dominance. It is in these that we will find, if we find it at all, the answer to our question. We do not expect diffuse feelings of generalized benevolence of animals; nor, of course, do they form any important part of altruism in humans. Real life is about much more specific things.

Well, are animals moral? Not, obviously, in the sense of the rationalist tradition. They do not 'draw out from their own actions any principles of action' Yet it seems clear that some will do naturally some of the things that a good man or woman should do. It is as higher mammals, Dr Clark maintains, that we are likely to find it easy to form or enter into local attachments of affection, be concerned for infants, wish to fit in with our fellows, and defer to dominants. We are also, ex hypothesis, likely to be unconcerned for (even hostile towards) strangers, ready to let the weakened starve and to react to disease in others by ostracizing them. Dangerous stuff. But I agree with Dr Clark that we should not be deterred from considering such possibilities by political fears. Perhaps it is the case that 'those writers who have made most play with the apparent analogies between human and non-human behaviour have been recognizably right-wing'; but if it is, a more precise remedy is needed than a denial that the notion of human nature has any application at all: it is also the only foundation, as far as I can see, on which any general concept of human rights can be grounded.