

bridge University Press).

Any book on time asymmetry can justifiably include a more detailed discussion of any of the well-known irreversible processes, because these always imply an arrow of time. But this would not be essential and might lengthen the exposition unduly. I fear that this has been done in the present book by including problems of decoherence in quantum mechanics: that is, the leaking out of quantum coherence from a system into the environment, leading to the emergence of classical behaviour. The 80 pages or so devoted to this topic thus deal essentially with the irreversible processes of quantum measurements. Indeed, B. DeWitt goes on record as saying that the arrow of time has no basic role to play in decoherence. Incidentally, the topic of decoherence can also be studied in the 1989 Santa Fe book.

Perhaps the most striking paper is by J. Barbour, who determined by a strawpoll

that a majority of the participants think that 'time' should be derivable (like temperature) in a truly fundamental theory. He proceeded to indicate non-mathematically an approach that might possibly achieve this; it is of course a little early to judge its success. One might go further and blame the 'accident' of our physiological make-up for the problem we have regarding time, its meaning and its asymmetry. Could, for example, a dematerialized intelligence grasp all developments in a flash and so not need a time coordinate?

The distinction of the participants and the intrinsic interest of the topics discussed make this a book that should be available to all physicists as well as to students of cognate subjects. □

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## Telling tails

*Robert Gibson*

**Arena Birds: Sexual Selection and Behaviour.** By Paul A. Johnsgard. *Smithsonian Institution Press: 1994.* Pp. 330. \$47.95, £26.75.

**Sexual Selection and the Barn Swallow.** By Anders Pape Møller. *Oxford University Press: 1994.* Pp. 365. £35, \$49.95 (hbk); £16.95, \$24.95 (pbk);

INTRICATE sexual ornaments such as the peacock's train defy an easy evolutionary explanation. Darwin thought that they attracted mates but was unable to explain why females should find such elaborate structures attractive. More recently the latter issue has become a battleground between adaptive and nonadaptive views of the evolutionary process.

Paul Johnsgard's book is a useful starting point for anyone interested in the plumages and antics of birds that inspired Darwin. Leks — gatherings of males visited by females for mating — have evolved in at least 11 avian families and are associated with extreme polygyny and some of the most elaborate examples of sexual ornamentation. Johnsgard's semi-popular account covers most of the lek-breeding species and some others (such as the bowerbirds and some ducks) with lek-like mating behaviour, and is copiously illustrated with photographs and his own pen-and-ink sketches. The bibliography provides an up-to-date entry into the primary literature.

At first sight, a socially monogamous songbird in which males possess outer tail feathers a fifth longer than females seems an unlikely subject for answering questions raised by the peacock's train. Yet

more has been learned about sexual selection from the barn swallow than from any lekking bird, due in part to the ease with which tail feathers can be lengthened or shortened with scissors and superglue. The story, based on a 10-year study in rural Denmark, is told by Anders Møller in his monograph. Its general interest is likely to rest on three principal results.

First, tail length affects a male's ability to acquire a mate, with many different consequences that influence his reproductive success. Second, females may benefit from mating with long-tailed males by avoiding infestation by ectoparasitic mites that abound on shorter-tailed males. There is also an intriguing indication, obtained by transferring chicks between nests, that females may gain genetic resistance to mite infestation for their chicks by mating with longer-tailed males, although the trait conferring resistance remains a mystery. Finally, tail length has the properties of a Zahavi handicap: long tails are indicative of phenotypic vigour (as shown by relationships between final tail length and both the rapidity and perfection of feather growth) and experimentally lengthened tails impose a mortality cost that falls more heavily on less vigorous individuals, which may explain why honest signalling is evolutionarily stable.

Møller's field studies are remarkable in scope, in the degree to which experi-

mentation has been employed and in the extent to which they confirm *a priori* theory. Collectively they make one of the most complete cases so far for adaptive female choice of a sexual ornament. But how robust are the conclusions?

This is more difficult to answer. One problem is that while marshalling data in support of particular hypotheses, Møller often fails to discuss plausible, though less interesting, alternatives. A recurrent issue is the extent to which differences in annual return rates represent survival as opposed to modulations of site fidelity in relation to previous breeding success (well known from many birds including the barn swallow).

Another is the extent to which resemblance between offspring and parents in characters such as tail length, mite load and survival represents additive genetic effects as opposed to direct parental and environmental contributions. These are not easy matters to resolve, but they critically affect the conclusions. A decision not to burden the text with technical details also robs the reader of sufficient information to evaluate particular results, and sometimes even to understand their origin. (I remain perplexed as to how 23 per cent of 81 unmated males were classified as committing infanticide when only 4 cases of infanticide were observed.) It is a pity that such problems erode confidence in some of the book's more interesting conclusions. □

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UNDERNEATH the arches — barn swallows (*Hirundo rustica*) feeding young.