than others (i.e. mate vs. uncle) are all unknowns at the present time; hopefully enterprising students can come up with experimental designs to test them. Comparative studies relating long-term individual recognition to degree and type of social organization would also be useful.

2. *Learning-memory.*—Allied with and not mutually exclusive of individual recognition is a learning-memory system. Such a system will add permanence to individual recognition. Memory has been given short-shrift by avian biologists, primarily because comparative psychologists, with their inappropriate apparatus and testing schemes, have not found strong evidence for it. Yet memory should be an important facet in a bird's life. It is hard to conceive of an accurate migrant or an optimal forager not having the ability to remember. Such should also be the case for socially organized birds. For example, if a bird is separated from the group does it search randomly for the group or does it remember the usual foraging beat and thus know where to look for them? Somehow birds should remember good feeding sites and be able to return to them. For example, in the irriputon winter of 1974–75 a Clark's Nutcracker (*Nucifraga columbiana*) was banded at our feeder. In the next irriputon year (1978–79) this same bird returned to the feeder—compelling but not rigorous evidence for memory. In terms of sociobiology one can construct many simple hypotheses about memory, such as: birds that make complex choices should remember complex information; birds that live longer should remember more than short-lived birds; social birds should remember characteristics about conspecifics better than less so ial birds. Young Piñon Jays nesting for the first time select nest-sites quite similar to those in which they were raised. This is certainly no coincidence, and strongly supports a suggestion that these birds possess the ability to learn habitat characters at a young age and remember them until they mature, 20 months later. These types of questions and findings will help resynthesize avian sociobiology.

The above two proximate mechanisms are but a small sample of those available for study. One of the major stumbling blocks in avian sociobiology is the time and effort it takes to understand the social system so that ultimate explanations can be proposed. Uniquely marked populations need be studied through a number of generations to gain insights to the genetic system in operation. Thus, these studies do not readily lend themselves to graduate thesis. But proximate studies, if carefully planned, can be conducted in a span of time not unreasonable for thesis work. Thus, graduate students should be able to share in the many advancements yet to be made in avian sociobiology.

ON SOCIO-ORNITHOLOGY

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Avian sociobiology has a long and distinguished history, including classic works by Darwin, Altum, Whitman, and Howard, the memorable works of Lorenz, Tinbergen, and Lack, and more recent studies by Marler, Orians, Crook, Wolf, Pulliam, and many others. Sociobiology is, of course, no more or less than what the name implies; all these authors have participated in it. Only the name, sociobiology, and

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its contemporary notoriety are novel. If generalizations are to be made about socio-ornithology, they must be judged against the works of these persons as well as against those of persons who identify themselves as sociobiologists.

Socio-ornithology is, fortunately, little afflicted with nature-nurture pseudodebates that the science journalists favor. On the other hand, we do have some serious problems. In the study of any animal's social behavior *anthropomorphism* is a constant danger. Anthropomorphism took a drubbing from ethologists in the 1930–50s, who emphasized the "objective study of behavior," but I fear that it is returning under the guise of "selfish genery." Too often the emphasis is on "selfish" and too infrequently on "gene." For example, in 1979 a paper read at the International Ethological Conference seemed to argue for individual selection because the bird "wanted" to be a sentinel.

A more difficult problem for socio-ornithologists is their preoccupation with "natural experiments." Such phenomena are extremely valuable in the exploratory phase of a problem, but they provide no more than correlations. When strong-inference tests (Platt 1964) are needed to separate rival alternative hypotheses, socio-ornithologists too often are expert at avoiding the necessary controlled experiments. For example, I have met widespread resistance to the idea of controlled experiments in the study of helping behavior in birds (Brown and Brown in press). Some workers in this field seem to be so comfortable with the ambiguities of correlations that the idea of controlled experimentation is quite unsettling. Only in avian sociobiology, it seems, is there such opposition to controlled field experiments.

Fortunately, the considerable inertia of status-quo thinking has not prevented some successful applications of the experimental method in avian socio-ecology. Among the success stories are studies on flocking (Caraco et al. 1980), mating systems (Pleszczynskya 1978), and resource defense (Ewald in prep.).

A third obstacle for socio-ornithologists is the difficulty of field genetic studies. Despite the reluctance of ornithologists to enter this field, some workers have overcome the status quo and have successfully applied genetic methods to social groups of birds (Baker and Fox 1978, Johnson and Brown 1980).

Sociobiology has its problems, but it is a flourishing and exciting branch of biology, as evidenced by the 1980 Dahlem Konferenz on Sociobiology (Markl 1980). Students of avian sociality who remove their blinders and look beyond the confines of avian taxonomic boundaries will undoubtedly make further contributions to sociobiology.

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