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SOCIOBIOLOGY AS LEARNED FROM A DRAB, BLUE BIRD

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As with all subsciences of biology, the tenents and principles of sociobiology are formulated from evolutionary theory based on fitness, adaptation, and natural selection. Individuals within a group (be it with mate, family, or nonrelative) perform in such a manner as to enhance their opportunities for present and/or future reproduction (individual fitness) and/or that of their relatives (inclusive fitness). Sociobiology simply adds emphasis to the latter without diminishing the more usual, historical emphasis placed on the former. Social organizations of birds, according to evolutionary theory, are a means of improving fitness.

Fitness is the conversion of ecological constraints such as food supply, nesting sites, and escape cover into viable offspring. Fitness improves when an organism becomes more efficient in the conversion process or expands the resource base available for conversion. Different social organizations should then reflect different ecological constraints (different kinds of efficiencies), expansion of the resource base (efficiencies that convert more of the resource base), or simply alternative methods to achieve some given level of efficiency in the conversion process. Although these three alternatives are not mutually exclusive, there should be enough differences between them to allow for the construction of competing hypotheses. This has seldom been done, as evolutionary biologists have concentrated on the former two options, the ecological ones. Social systems are said to reflect ecological conditions. These conditions can all be lumped into what are called *ultimate factors*. Current theories about avian social systems deal extensively with these ultimate factors. This is what one would expect from a new, fledgling science. In some cases theories about social behavior have come into direct conflict with one another. Helper systems in some species are said to occur where the climate is harsh and unpredictable and the breeding birds must marshall all available reserves in the form of time and energy to breed successfully before inhospitable conditions reoccur. Yet most social birds are found in areas of temperate climate, where migration is not so extensive and

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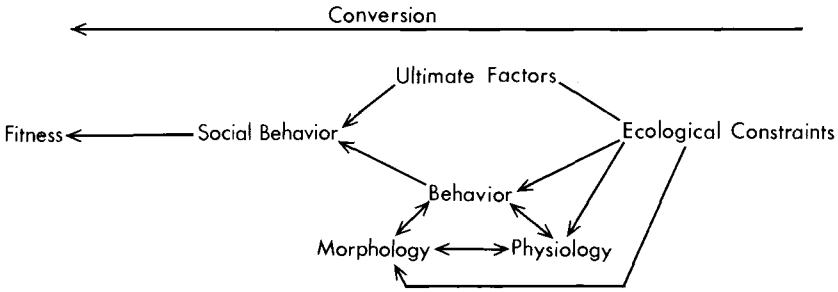

Fig. 1. Schematic representation of the two methods of approaching the study of avian sociobiology. Ultimate solutions are often proposed after the ecological constraints and social organization have been studied. These ultimate solutions, however, are mediated through proximate operations, primarily behavioral ones.

family units remain together. Obviously, *ultimate explanations* (those based on ultimate factors) will vary between and quite possibly even within species. Ultimate explanations, however, are often all we even get to as the evolutionary biologist turns now to new and different questions. In my mind, a real worth of ultimate explanations lies in their ability to suggest hypotheses about the social system as an efficient converter of ecological constraints into viable offspring. The methods by which the actual conversion occurs fall into the category of *proximate factors*. If our ultimate explanations are correct, then predicable *proximate hypotheses* could be formed and tested. These factors responsible for the conversion process are in the form of behavioral patterns, as mediated through the physiology and morphology of the bird, and are under the control of natural selection. Factors ranging from visual acuity for food and predator location to the use of a wing or tail patch to convey information fall into this category. *Proximate adaptations* are the quantitative means by which the conversion can be gauged in terms of efficiency (Fig. 1).

An interesting analogy exists here between proximate factors in sociobiology and those in migration and orientation. We have a rather strong set of hypotheses about the ultimate reasons for migration, but even the most recent work on how birds accomplish these (proximate explanations) leave us with much work still to be done. The same is true for sociobiology, even with its relatively weak set of theoretical tenents compared to those of migration. Some areas of study that look fruitful at the moment are briefly discussed below:

1. *Individual recognition.*—In higher vertebrates that make discriminate choices of mates, foraging sites, food items, or nest-sites from a wide array of possibilities, one could expect long-term individual recognition to be prevalent. Avian biologists have not been quick to grasp the significance of this idea, as the literature is barren on this topic for passerine birds. Yet many incidences must be buried away in field and laboratory notes. We once removed a female Piñon Jay (*Gymnorhinus cyanocephalus*) from her known mate and placed her in isolation. During the ensuing 6 weeks of captivity her mate formed a pair bond with a new female. When the female was released into the flock she immediately attempted to solicit food from her original mate, forming an interesting "triangle." This is compelling but not rigorous evidence that individual recognition occurs. We can postulate that birds must possess long-term individual recognition, but what features they use, how many birds can they recognize, who are the birds they recognize, are some birds more easily recognized

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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