Avian Altruism

African birds sacrifice self-interest to help their kin

By KATHY A. FACKELMANN

White-fronted African bee eaters will face spitting cobras, forage tirelessly for bees and delay having their own young—all to help close relatives raise a clutch of baby birds. Why would any bird engage in such magnanimous behavior? Years of direct observation have led two scientists to suggest this altruism is an inherited trait that gives the "helper" bird's family a survival edge in the harsh African savannah.

"Helper birds postpone opportunities to breed in order to help family members," says Cornell University biologist Stephen T. Emlen. But the behavior is genetically "selfish" because it helps young relatives survive, thereby perpetuating the family's genes, Emlen says. He and Peter H. Wrege recently completed a five-year study of a population of white-fronted bee eaters, *Merops bullockoides,* living in Kenya's Lake Nakuru National Park. The results, they say, help explain the evolutionary paradox posed by altruistic behavior.

Until the 1960s, scientists held that natural selection favors only those behaviors that boost the survival chance of the individual and its offspring. A bird that postpones its own reproductive potential to help another would seem doomed from that evolutionary standpoint. But Emlen and Wrege show that many white-fronted bee eaters willingly place their relatives' needs before their own, supporting a theory put forth in 1964 by William D. Hamilton at Oxford University in England. Hamilton coined the term "inclusive fitness" for his belief that natural selection also favors behavior that helps close kin survive.

The Cornell biologists observed a colony of about 200 bee eaters living in multigenerational family units called clans. They constructed complex genealogies by keeping track of all births and deaths during the study period. Bee eaters make their nests by burrowing into the eroded cliff walls of riverbanks. By rigging up a set of dental mirrors mounted on long tubes, the scientists could spy into the nests, recording when eggs were laid and hatched. They gently removed young birds from nests to fit them with color-coded wing tags and numbered leg bands. Because bee eaters live an average of five years, Emlen and Wrege were able to chart full family trees for nearly all the birds they followed.

A typical clan consists of one to five mating pairs plus a group of single birds. Almost 60 percent of bee eaters remain paired to the same bird for life, Wrege notes. During breeding season, a reproductively active pair will enlist as many as two helper birds to help build a new nest and forage for bees, butterflies and other insects that make up the bee-eater diet. The helpers — which may be "singles" or mated birds postponing breeding for the season—assist in rearing the fledglings for up to six weeks.

Kinship is an important predictor of which birds will offer such assistance to which breeding pairs, the scientists reported in the December BEHAVIORAL ECOLOGY AND SOCIOBIOLOGY. Emlen and Wrege studied 174 cases of helping behavior among birds of known parentage. They found that in 88.5 percent of the cases, helpers were genetically related to the breeding pair. Adult sons or daughters helped their parents raise full siblings in 44.8 percent of the 174 cases observed. Grown offspring helped a parent or stepparent rear half-siblings in 19 percent of the cases. And the younger generation wasn't the only group to help. In 10.3 percent of the cases, parents "birdsat" the brood of a son and a daughter-in-law.

In 115 of the cases, helper birds had a choice between two breeding couples with varying degrees of relatedness. Family ties made the difference in nearly every case, with helpers foraging for the most closely related nestlings 94 percent of the time. Helpers get the biggest genetic payoff by ensuring the survival of their closest kin, the researchers say.

In-laws and distantly related birds, in contrast, were much less likely to work for other clan members. Most in-law bee eaters are females that have left their natal clan to join the extended family of a mate. They are socially integrated in the mate's clan but are genetically unrelated to members other than their own offspring. These in-laws rarely "lift a feather," even though their mates may be working hard to bring in enough bees and other delectables for a related couple's hungry brood, Emlen says.

In-laws may fly back to their natal clan during times when the colony experiences a food shortage, the researchers found. In eight additional cases studied, birds temporarily left their partners' clans to help their parents, or a parent and a stepparent, raise a family. All of these helpers returned to their mates after the breeding season.

The birdwatchers did find exceptions to the relative rule. In 11.5 percent of the 174 cases observed, birds helped a breeding couple to which they were unrelated. This finding is puzzling, Wrege says, because birds that help nonrelatives engage in evolutionarily costly behavior and get no apparent benefit.

Close examination of such cases revealed some intriguing patterns. Bee eaters can lay just one egg every other day, but there were times when Emlen and Wrege spotted a new egg on the breeder's nonlaying day or two eggs appearing in one day. They say this suggests that some single females surreptitiously laid an egg in another couple's nest while the primary breeders were away foraging, and then volunteered to assist in rearing their own offspring.

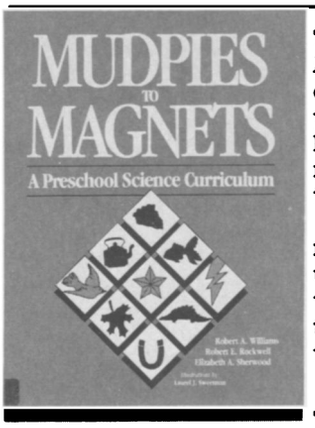
In other cases, the unrelated helper had a social tie to one or both breeders. For example, one male bird who had failed in his own reproductive attempt volunteered to help at the nest of his ex-mate and her new mate. The offspring continued to interact with him as though they were genetically related, offering him assistance with his brood as they grew up, Wrege says.

Young bee eaters appear to learn kinship recognition as they mature, the researchers say, but further research is needed to identify exactly how this process works. Wrege notes that the birds feeding the young are likely to be their parents or close relatives. The case in which fledglings treated their mother's ex-mate as kin suggests they have no genetically determined way to recognize blood relatives, he says.

To test that hypothesis, he and Emlen put 25 hatchlings in "foster" homes. Later in life, the birds offered help to their foster parents and treated their biological parents as non-kin.

For families trying to eke out an existence, helping behavior does seem to pay off. "Their food supply is very unpredictable," Wrege says. A pair with a helper can successfully raise twice as many young as a pair with no help, the researchers point out.

Emlen and Wrege believe African bee eaters provide evidence for the evolution of helping behavior even among birds



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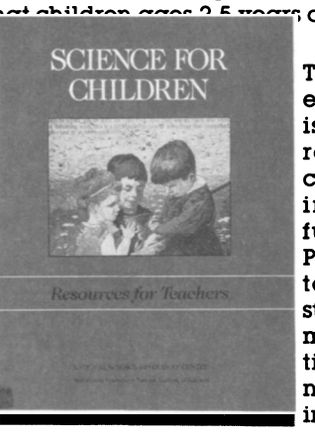

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that gain no direct personal benefits from their action. Other researchers have suggested that some bird species do benefit directly by helping another couple raise a family. For example, they note, young helper birds may gain experience that boosts their chance of successfully raising offspring of their own later on. In bee eaters, however, a comparison of first-time breeders with and without prior helping experience showed that this factor had no effect on the number of young produced, report Emlen and Wrege.

Birds aren't the only creatures displaying altruism. Scientists have observed such behavior in mammals and especially in insect colonies. Humans, however, may be a different story. "Altruism is so hard to define in human beings," says pioneering sociobiologist Edward O. Wilson of Harvard University, who notes that scientific controversy still rages over a possible genetic origin for human altruism. Wilson himself thinks scientists will discover specific genes for human altruism in the near future. Other scientists argue that human altruism is not genetically determined but instead springs from social conditioning or peer pressure.

In the meantime, cynics and believers alike will find the ever-obliging *M. bullockoides* toiling away, snatching winged morsels to tempt tiny siblings, nieces and nephews. □