Why lions decide to be laid back

Breeding is one realm of animal behavior where aggression toward members of the same species, if it occurs at all, is likely to be found. Observations of wild lions in Tanzania have shown that males courting females form "cooperative coalitions" of one to seven adults that maintain exclusive rights to a female pride of two to 18 adults. Because researchers rarely saw fights among these males during mating, they assumed that there was no intra-coalition competition for females and members shared them equally. The most popular explanation for this phenomenon was that mating coalitions were comprised of genetically close relatives and allowing brothers to mate freely would result in passing on more of the family's genes — a behavior indicative of an evolutionary process called "kin selection."

Two University of Chicago biologists, Craig Packer and Anne Pusey, report in the April 22 NATURE, however, that members of breeding coalitions are, contrary to what has always been believed, sometimes aggressive toward other members and that those other members are frequently not their relatives. The researchers studied two populations of African lions for three years, collecting over 500 hours of behavioral data.

They found that breeding coalitions are made up of non-relatives nearly as often as relatives — 42 percent of the time. And even when coalitions did contain close relatives, this had no effect on the level of cooperation or competition. They also discovered that aggressive competition was common within the coalitions, at least when the temporary "ownership" of a female by a male had not been established. Aggression consisted of both threats and actual fights, although threats were more common.

After ownership is established by a male, however, other lions will leave him alone. Why? Packer and Pusey suggest that an answer may be found by looking at "game theory." A mathematical concept only applied to animal behavior eight years ago, game theory has to do with weighing the possible "payoff" of winning a conflict against the possible "cost" of losing it—similar to some human games. It is very "expensive" for lions to fight, says Packer, "and when they do, both the winner and loser are frequently injured — often seriously." Thus, once ownership of a female has been established, it makes more sense for a competing male to look elsewhere for another female rather than risking injury. In addition, previous studies have shown that males that cooperate, in general, end up fathering more offspring. "Another way of looking at it," says Packer, "is straight forward selfish behavior."

Packer believes that some other animal behaviors, traditionally accounted for by the popular kin selection theory, may turn out to have other explanations as well. In many species of birds, for example, some males stay home and help their parents take care of other offspring rather than having any of their own because, it has been presumed, they are increasing the genetic contribution of the family. "But in many of these examples helpers have turned out to be unrelated," Packer told SCIENCE NEWS. "There are many reasons why it's beneficial to cooperate with conspecifics — relatives and non-relatives alike." —*L. Tangley*

African Wildlife Leadership Foundation

Tanzanian lion: Why fight when you might get hurt?

NRC's invalid rules

Last week, the U.S. Court of Appeals for the District of Columbia concluded that Nuclear Regulatory Commission rules on the environmental impact of the uranium fuel cycle were invalid because "they fail to allow for proper consideration of the uncertainties concerning the long-term isolation of high-level and transuranic wastes, and because they fail to allow for proper consideration of the health, socio-economic and cumulative effects of fuel-cycle activities." At issue was whether a table of numerical values, used when licensing nuclear reactors, properly reflected the environmental effects of building and operating a nuclear reactor.

Judge Malcolm R. Wilkey, dissenting from the 2-to-1 opinion, argued, "It is not our job to substitute our judgment for the agency's to reach what we perceive to be the best or correct result. It is not clear just how the invalidation ... will help the NRC to make a better decision than it has already made." If the decision stands, the NRC will have to revise the rules. Judge David L. Bazelon noted that NRC licenses already granted under the rules are not at issue in the case. □

Synthetic success: Poppy-free opiates

The codeine now used in medicines such as cough syrup is the chemical real McCoy — it comes right from the opium poppy, *Papaver somniferum*. And because cultivation of this plant is prohibited by federal law, the United States relies on foreign sources — mostly India — for the 60,000 kilograms of codeine and other medically important opium compounds prescribed here each year. Now, a significant step has been taken toward ending this reliance on foreign opium sources by providing synthetic analogs of the plant's compounds: Kenner C. Rice of the National Institute of Arthritis, Diabetes and Digestive and Kidney Diseases has achieved the first relatively simple, total synthesis of opium derivatives. Rice reported his synthetic scheme at the recent American Chemical Society national meeting in Las Vegas, Nev.

Synthesis of opium-derived drugs previously has been reported by at least eight different groups. All of those schemes, however, are complex, time-consuming and expensive. Rice's work, on the other hand, appears to represent a major advance toward the eventual large-scale manufacture of the compounds.

The synthesis begins with a readily available organic chemical called *m*-methoxyphenylethylamine. The key reaction in the scheme — which forms an essential carbon-nitrogen skeleton — is called a "directed Grewe cyclization (ring-forming reaction)." That particular step has been unsuccessfully attempted by other scientists studying the synthesis of opium derivatives. Rice attributes his success of the Grewe reaction partly to his use of a "super acid," trifluoremethanesulfonic acid, as catalyst — a chemical that accelerates reactions without undergoing change itself.

The new portion of Rice's synthesis ends with three opioid substances: dihydrocodeinone, dihydrothebainone and nordihydrocodeinone. These intermediates can easily be transformed into the medically useful opium compounds. (Henry Rapoport and D.D. Weller of the University of California at Berkeley previously demonstrated this latter portion of the synthesis by working backwards from natural poppy material.)

Even if the total scheme proves economically impractical on an industrial scale, it still will provide a potential back-up to the poppy-derived compounds when crop failure or socio-political reasons result in a shortage, Rice says. (From 1973 to 1975, shortages forced the U.S. government to release emergency reserves of opium for the needed drugs.) In addition, the scheme produces not only the synthetic analogs of the natural forms of opium derivatives, but also mirror-image forms not found in nature that are useful in the research of the chemistry of the nervous system. Specifically, the mirror-image forms are not recognized by nervous system receptors, so they can be used to determine which opiate effects are receptor-mediated. —*L. Garmon*