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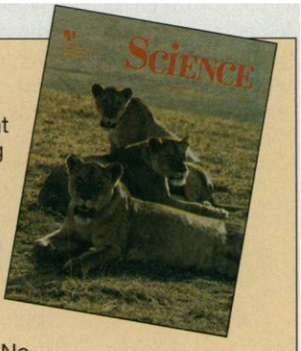

Big cats

Why are some female lions (right) bold and out front when hunting (or defending territory), while others hang back timidly? A report about "cowardly lions" prompts some interesting questions about behavioral theory and field observation. Lyme disease, which sometimes appears to persist after antibiotic treatment, presents a special challenge for clinicians (who can miss—or misdiagnose—the disease), epidemiologists (who might under- or overreport its prevalence), and researchers (who must design a valid study in these shifting sands). No small matter, this illness—spread by deer ticks—is now "the most common vector-borne disease" in the United States. And how a society thinks about, and funds, the "endless frontier" of scientific endeavor continues to be debated.

Lioness Leadership

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The explanations of cooperative lion behavior considered in the interesting article "Cowardly lions confound cooperation theory" by Virginia Morell (Research News, 1 Sept., p. 1216) and in the excellent report "Complex cooperative strategies in group-territorial African lions" by Robert Heinsohn and Craig Packer (1 Sept., p. 1260) appear unnecessarily complex. Initially it was hypothesized that "laggards" are punished by "leaders" and that this prevents laggards from destabilizing cooperative groups. When Heinsohn and Packer demonstrated that laggards are not punished and that leaders consistently protect their territory regardless of laggard behavior, Alex Kacelnik (p. 1217) suggested that the laggards may provide other services to the group so that leaders forgive them.

Actually the existence of laggards is not unexpected. Lagging behind another lioness is a safe strategy that one would expect to spread. The question then is: Why are there any leaders? This generates the testable hypothesis that there is some reward associated with being a leader. Perhaps the territory is not used equally by all lionesses and their offspring. Leaders may have access to the choicest portions of the territory. Although there is not an obvious dominance hierarchy among lionesses, maybe leaders are less likely to be challenged for resources by other lionesses within the same group, so that leaders have fewer fights. Or perhaps, leaders are more attractive to male lions, giving leaders a greater choice of mates.

That additional benefits raise the inclusive fitness of leaders seem more likely than a situation where leaders must regulate the inclusive fitness of laggards.

Response: Certain females may lead while others follow because (i) leaders specialize in territorial defense while laggards specialize in other activities (as Kacelnik suggests), (ii) leaders gain more than laggards from territorial defense (as Jahn suggests), or (iii) leaders may be better fighters and thus suffer lower risk of injury [as M. Milinski has suggested to us (*1*)]. Although we cannot exclude any of these possibilities with certainty, our limited data on hunting behavior show no relation between leading during territorial defense and leading during a group hunt (contradicting Kacelnik). Contrary to Jahn's suggestion, each female uses all parts of the communal territory (*2*), females show no dominance hierarchies (*3*), "challenges for resources" are symmetrical (*3*), and males do not show any obvious mating preferences (*4*). Indeed, our playbacks were always performed when no males were present in the vicinity. Milinski's suggestion is harder to test without standardized measures of fighting ability, but this too seems unlikely, as there was no tendency for leadership to change with age; as we stated in our report, females can be classified as leaders or laggards by 8 months of age (*5*), yet they do not reach full size until they are more than 2 years old. Nor did we find any relation between lagging behavior and adult body size. Thus it is highly unlikely that females base their behavior on fighting ability.

Female lions share a common resource, the territory; but only a proportion of females pay the full costs of territorial defense. If too few females accept the responsibilities of leadership, the territory will be lost. If enough females cooperate to defend the range, their territory is maintained, but their collective effort is vulnerable to abuse by their companions. Leaders do not gain "additional benefits" from leading, but they do provide an opportunity for laggards to gain a free ride.

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Treatment of Chronic Lyme Disease

Eliot Marshall's News & Comment article "NIH gears up to test a hotly disputed theory" (13 Oct., p. 228) and several statements in a subsequent letter by Peter McFadden (1 Dec., p. 1419) require comment. At issue, according to Marshall, is whether there is a chronic form of Lyme disease that sometimes persists after a course of conventional antibiotics has been given.

When my colleagues and I recognized Lyme disease as a separate entity in 1975 (*1*), we were fully aware of the medical literature about three entities that had been loosely linked with one another in Europe: an expanding skin lesion called erythema chronicum migrans (*2*), an atrophic skin condition called acrodermatitis chronica atrophicans (*3*), and a neurologic syndrome called Bannwarth's syndrome (*4*). However, in Europe, these syndromes had not been associated with arthritis, and it was not clear whether the European experience could be extrapolated to the multisystem illness that we were studying in the United States.

After our early reports about erythema migrans and Lyme arthritis (*5*), my colleagues and I described other features of the illness, including cardiac, eye, and acute and chronic neurologic manifestations (*6, 7*). I thus fully recognize that Lyme disease is a chronic, multisystem illness that may occur in active or latent forms over a period of years.

I was originally skeptical of the role of antibiotics in treating Lyme disease, and my early articles reflect this point of view. However, controlled studies had not yet been done in Europe when I wrote those articles, and my colleagues and I proceeded to do them (*8*). They were begun before the causative agent was known and played a major part in establishing the role of antibiotics in the treatment of this infection.

Treatment failures may occur with short-term antibiotic regimens (2 to 4 weeks orally or 4 weeks intravenously), and retreatment may be necessary (*9*), but there is no convincing evidence that courses of antibiotics for many months are of benefit in the treatment of Lyme disease, and such therapy has a significant risk of side effects (*10*).

There are many explanations, only one of which is active, ongoing infection (*11*), for persistent symptoms after standard courses of antibiotics have been given to patients with Lyme disease. Patients with chronic neuroborreliosis may have persistent spirochetal infection in the brain after