

SNAKE CHASTITY PLUG: HIS OR HERS?

A chemical cue signals the state of mated female garter snakes

BY JULIE ANN MILLER

Garter snakes need a fair return on sex. No just fooling around. If a male is going to be prolific, he must make the most of those first spring days when snakes emerge from hibernation. Not only is time of the essence, courtship is a risky business. Hawks and crows zero in on mating garter snakes. Many males often court a single female forming a writhing mass and constantly jockeying for the prime position. "Courtship stands out like a sore thumb," says Michael C. Devine, now at Fairleigh Dickinson University in Teaneck, N.J. "It attracts my attention and presumably attracts a predator's attention, too."

Research in the snakes' natural habitats, as well as in the laboratory, suggests that a chemical signal guards against chancy but unproductive encounters. Devine, while observing snakes in a denning area in Michigan, noticed that some female snakes were unaccompanied while others were vigorously, and numerous, courted.

Devine and other researchers had observed that the reproductive opening of the female snake (the cloaca) sometimes contains a gelatinous copulatory plug, which is deposited by the male after insemination. At first biologists assumed that the main function of that plug was to prevent sperm leakage. Now another role has been detected. Male garter snakes recognize females with copulatory plugs as off limits. "I interpreted this as a form of intrasexual competition in which the successfully copulating male makes the female temporarily unavailable to other males and reduces the likelihood of multiple inseminations," Devine says.

Of the female snakes Devine spotted during three mating seasons, none of 23 females that had plugs was courted. Thirty-five females found without plugs were courted, while nine slithered around alone.

Devine intervened in the mating scene to further test the chastity plug hypothesis. He presented a male snake with the mid-body portion of a selected female. Two snakes out of 24 courted females both with and without plugs. The vast majority only courted females without plugs.

Other researchers, Patrick Ross Jr. and David Crews of Harvard University, ex-

amined closely related garter snakes in a laboratory setting. They independently concluded that males discriminate against recently mated females on the basis of the copulatory plug. "Most non-mated males failed to court mated females even though they had courted the same female immediately prior to the female's copulation," Ross and Crews report. Their experiments provide the most direct evidence that the plug is involved. When the researchers washed out the plugs with alcohol and water, most mated females were again courted. Furthermore, unmated females that had been smeared with cloacal material from mated females lost their sex appeal. Only one out of eight was even perfunctorily courted.

The origin of the chastity-imposing scent remains a point of contention. The Harvard team believes the male produces it to protect his investment. In their most recent studies, Ross and Crews performed vasectomies on snakes to prevent deposit of plugs, although mating remained normal. Females mated to those snakes remained attractive. Crews says, "Although we can't say for certain the plug the male produces doesn't react in the female cloaca to produce an active substance, we do know that something produced by the kidney in the male is required."

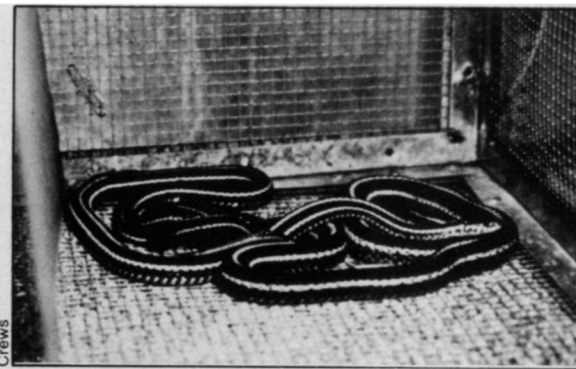
Much of the argument is evolutionary, rather than biochemical. Ross and Crews observe that exposure to a mated female reduces the ardor of males toward other, unmated females. They also report that the male is unable to mate for at least 24 hours after copulation. The investigators suggest that odors deposited by the male increase his reproductive success by temporarily removing other males from the breeding population. Such a far-reaching effect on courtship behavior would be unique.

Devine, on the other hand, believes that the discouraging scent comes from the female snake herself, perhaps in response to the copulatory plug. In the field, Devine has seen no evidence of either an inhibitory effect of a mated female on a male or of a refractory period in males after mating. Devine argues that if one male evolved a scent that could inhibit other males from courting an eligible female, it would become highly advantageous for other males to ignore that signal.

Devine says the cue must come from the female. "If males are capable of producing any cue that would deter other males, because of the tense competition of courtship, the male would use the cue at the very start of things, so as to have



Unrestrained male garter snake courts a female held by researcher in the field.



Caged male snake rubs chin on female during courtship in laboratory experiment.

the female all to himself," Devine proposes. "He could let out a little plug material at the onset, but this doesn't happen."

The differences, according to Devine, may be due to the type of experimental environment. "In nature males move from place to place locating females," he says. In the laboratory experiments Ross and Crews transfer females in and out of the males' cage. The females may contaminate the cage with the inhibitory scent, so that the males erroneously identify new females as producers of that odor. Crews agrees this is a possibility, but finds it unlikely. He explains that male snakes in nearby wiremesh cages are unaffected and also that the inhibition of mating behavior lasts only 15 minutes, while the plug material remains potent for at least a day.

Whoever is responsible for the chastity cue, it is a provocative entry in the lexicon of chemical communication among snakes. □