The power of estrogen -- male snakes attract other males

February 10 2012

A male garter snake flicks its tongue on another snake in order to detect pheromones and determine whether or not it's a female. (Photo courtesy of Oregon State University)

A new study has shown that boosting the estrogen levels of male garter snakes causes them to secrete the same pheromones that females use to attract suitors, and turned the males into just about the sexiest snake in the neighborhood – attracting dozens of other males eager to mate.

This experiment in the famed garter snake caverns of Manitoba, Canada, was one of the first in a field setting to ever quantify the effects of estrogen as a stimulant of pheromones, scientists said, in research just published in the *Journal of Experimental Biology*.

This estrogen, they said, is the same exact chemical found in many animal species, ranging from snakes to amphibians, fish, mammals and humans. The research confirms once again the unusually powerful role that estrogen can play in biology, and is also relevant to widespread concern about the environmental impact of compounds that mimic the effect of estrogen, found in some chemicals and pesticides.

In this study, male snakes were implanted with a small capsule that raised their estrogen level to about that of female snakes. After one year of this estrogen supplementation, the male snakes exuded a pheromone that caused other males to swarm to them and form the writhing "mating balls" that this species of garter snake is known for.

And just as the pheromone production could be stimulated, it could be taken away, the scientists found. When the supplementation was removed for a year, the males reverted to normal function and behavior.

This female garter snake is entwined in a "mating ball," being sought by numerous other male snakes. (Photo courtesy of Oregon State University)

"We thought this might work, but we we're surprised the results were so compelling," said Robert Mason, a professor of zoology and one of the world's leading experts on reptilian pheromones. "The amount of estrogen the male snakes received was nothing unusual, just about what a normal female would produce.

"And this was not just some laboratory test," he said. "These snakes were trying to mate in a natural outdoor environment, in which the males were absolutely sure they had identified a female snake."

The red-sided garter snake studied in this research depends totally upon pheromones for males to be attracted to and identify female snakes, by actually licking the female with a quick flick of their tongue. But the chemical cues are so extraordinary that in an instant, from one lick, the male can determine the species, sex, population, season, reproductive condition, size and age of its possible partner.

Pheromones are chemical cues that can provide a range of information, and often play a critical role in sexual attraction and reproduction. Snakes are a good model for studying them, Mason said, because they are totally dependent upon them for reproduction.

In garter snakes, the experiments showed just how powerful the mechanism is. Large and older females, preferred by male snakes because they can produce more babies, also have a slightly different chemical signature in their pheromone. Young, small, females can still attract suitors, but not as readily.

When male snakes had their estrogen levels elevated, their pheromone production was so strong that other male snakes actually preferred them to small female snakes.

Snakes use a "vomeronasal" organ in the upper palate of their mouth that plays a key role in this sensing process. Other animals, such as dogs, also have keen vomeronasal sensing abilities. Humans still have this organ, but it's unclear what role, if any, it plays in human sensory ability, Mason said.

The area where this research was done is a natural wonder, many scientists say, attracting hordes of tourists. Each spring, tens of thousands of snakes emerge from limestone caves north of Manitoba, Canada, in an intense competition to mate. Female snakes are swarmed as they emerge from the caves by multiple males that form large, twisting balls, attempting to be the first to mate with the female.

After that, a different pheromone is emitted which confirms the mating has been accomplished, and the other males lose interest and leave.

Provided by Oregon State University