Birth control for rats? Don't laugh, it's a reality, and cities want it

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Four pairs of breeding rats and their progeny can give rise to 15 million offspring over the course of one year, adjusting for litter size, the offspring's sexual maturity and how often females can reproduce. Credit: University of Arizona

One person died and two others fell ill last February in New York City

after contracting Leptospirosis, a disease caused by the bacteria Leptospira. The bacteria are transmitted to humans through cattle, pigs, horses, dogs and, as in this case, rats. Left untreated, Leptospira can cause kidney damage, meningitis, liver failure, respiratory distress and even death, according to the Centers for Disease Control and Prevention.

So serious is the matter that New York's official website includes a portal dedicated to handling complaints about the rodents as well as riches of information about the little mammals. New Yorkers and others can report rats in restaurants, rats in residence, rats in sewers and rats on public transit, not to mention rats loitering in streets and on city sidewalks. The site urges humans to rid themselves of rats through sound sanitation, a well-sealed home—and poison, or rodenticide, the last option that is frowned upon by some.

But enter SenesTech, based in Flagstaff, Arizona, the maker of ContraPest, a non-toxic, fertility-control product with its roots at the University of Arizona. This month, SenesTech will begin its collaboration with the New York Department of Health to target rat infestations at certain sites in the city. Through the UA Office of Technology Transfer, which has since been reinvented as Tech Launch Arizona, the UA first applied for the patent for ContraPest's liquid-bait technology in 2002 and licensed it exclusively to SenesTech in 2005.

Female rats, like all female mammals, are born with a set number of eggs. ContraPest works by using a chemical known as 4-vinylcyclohexene diepoxide, or VCD, to destroy female rats' ovarian follicles in their most immature form, each of which contains one egg. The destruction of ovarian follicles is itself a natural process that occurs over time in all female mammals, but VCD accelerates it. VCD will impair sperm production in male rats, but it's reversible.

What's more, and of note, VCD is non-toxic.

"I started working with VCD in 1989 and even by 2000, I kept coming up with the same answer, which is that VCD wasn't toxic," says Patricia Hoyer, UA emeritus professor of physiology. Nor is the chemical toxic when rats excrete it, Hoyer adds. It also appears to be safe for humans, pets, livestock and wildlife, she says.

Interestingly, it was a phone call from UA colleague Glenn Sipes in the Department of Pharmacology and Toxicology back in 1989 that got Hoyer interested in VCD.

"My colleague said he had a graduate student who found a chemical that, if given to mice or rats, would cause damage to the ovaries," Hoyer says. "He said, 'I know nothing about reproduction, and you do, so would you like to collaborate?' And I said sure."

At about that time, Loretta Mayer joined the Hoyer lab at the UA as a postdoctoral researcher. She was charged with the project of developing a mouse model for menopause based on what was known about VCD. Eventually, Mayer had the idea of designing a practical application for the model, so she developed bait traps and tested them on farms and in transit systems in Chicago and New York—all with great success.

"When people conduct studies in women after menopause, and they see something that's abnormal, they don't know whether it's age or the status of the ovaries," Hoyer says. "But with this model, we can accelerate the model of ovarian failure in a young animal, which removes the age factor but the animal retains its residual ovarian tissue."

Their years-long research with the mouse model of menopause has given rise to studies into complex disorders associated with postmenopausal women such as osteoporosis, cardiovascular disease, metabolic syndrome and ovarian cancer.

Mayer, now chief executive officer of SenesTech, developed the liquid-bait system. And by all accounts, the formula, which includes VCD, is quite appealing to rodents. Mayer says she has been tasting it herself for 14 years. After visiting bait stations to partake in ContraPest, rats readily return for more.

"They put sugar in it and oil and fat, things to make it taste good," Hoyer says. "The rats love it, and they remember it tastes good, so they go back for more. And people are crazy about this approach because it doesn't kill the animal. It's like having them on permanent birth control."

Which is of paramount importance, considering rats' reproductive proclivity. It's projected that four pairs of breeding rats and their progeny can give rise to 15 million offspring over the course of one year, adjusting for litter size, the offspring's sexual maturity and how often females can reproduce.

"The potential for worldwide use is tremendous because rats are pests around the world," Hoyer says.

Rats are known in Southeast Asia for raiding field crops and in Europe for infiltrating the public transportation systems as they do here. Likewise, it's estimated that rats damage roughly 40 percent of food shipped by sea, Mayer says.

Mayer says it's important to note that years of fundamental science have given rise to a global solution in controlling rats.

ContraPest won't eradicate rats from the face of the world, Hoyer says, "but it will get rid of them in the places where you don't want them."

Provided by University of Arizona