

Scientists tag NYC rats with RFID microchips to study their behavior and potential for transmitting disease

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Two of the authors, Michael Deutsch and Michael H. Parsons, anesthetizing a NYC rat before tagging it with an RFID microchip. Credit: Michael H. Parsons

For the first time, researchers are able to study the daily activity of some of the most abundant, most dangerous and secretive, and least known denizens of the world's great cities: rats. In the open-access journal *Frontiers in Public Health*, scientists present a novel, cheap, and safe method to tag city rats with RFID (Radio-Frequency IDentification) microchips and track their individual movements over several months. The new method, tried and tested on New York City rats - nicknamed "Ghosts of Gotham" because of their elusiveness - is expected to yield a wealth of data on the behavior of city rats and their potential for transmitting disease.

"We don't know much about the behavior of city [rats](#), or as much as we need to know about the organisms they can transfer to humans, either directly or indirectly through ticks and fleas," says Michael H. Parsons, a researcher at the Department of Biology at Hofstra University, Hempstead, New York, and lead author of the new study.

"For example, there are currently no known routine surveillance programs for rats in the USA, nor are the population dynamics of rat pathogens systematically monitored in any part of the world. But it's imperative that we study these subjects because by the year 2050, 75% of the world's population will live in urban areas, and could therefore be exposed to rat pathogens. Even today, rats and other rodent pests cost the US an estimated economy \$19 billion per year from food loss, infrastructure damage, and disease."



Rat burrows in a NYC park. Credit: Michael H. Parsons

Known rat-borne diseases include Rat bite fever, Rocky Mountain spotted fever, and Lyme and Cat-scratch disease, but it is certain that many other rat-borne pathogens remain to be discovered: for example, in a 2014 study in the journal *mBIO*, researchers found 18 viruses new to science in a sample of only 133 New York City rats.

But studying wild rats is difficult. Current knowledge about rats comes mainly from non-representative observations on migrating or exceptionally gregarious rats that are active during daylight. Rats are also

dangerous to handle, and quickly learn to avoid recapture in traps, while traditional methods for animal tracking, such as radio-telemetry or GPS tagging, often fail in cities where signals are blocked by infrastructure. The new method is the first to overcome these challenges.

"We developed the first safe method - not only for researchers, but also for the rats - for collecting pathogens from the same rat individuals over time, while monitoring their individual behaviors and predispositions. We show that rats can be effectively monitored with RFID microchips, without a lot of funds - the total cost of our equipment was less than \$ 15,000," says Parsons.

Parsons and colleagues give a step-by-step description of the method, including how to locate rat colonies, trap rats, anesthetize them, take blood, fecal, and skin parasite samples for disease testing, and surgically implant an RFID chip - about the size of a rice grain - under their skin. Once tagged rats are released back into their original environment, their [daily activity](#) can be monitored through RFID reading stations, which are treated with natural rat scents - easily extracted from the soiled bedding of laboratory rats - to attract wild rats. Each time a tagged rat comes within a few inches of a station, its presence is registered, while a weighing scale and camera automatically collect weight data and video footage.

Initial results show that rats have different personalities: some are shy, and some are bold. There is also a pronounced sex difference in activity: female rats were most active between the daylight hours, while males were active throughout the day and night.

"We're looking forward to seeing others using or improving our protocol, so that rat populations and their pathogens can be systematically monitored to help protect against potential disease outbreaks," concludes Parsons. "Even in our home city of New York, with more than 8 million

people, there are fewer than 10 institutional researchers pursuing rat research - perhaps we can help change that."

More information: A detailed protocol to enable safe-handling, preemptive detection, and systematic surveillance of rat-vectorized pathogens in the urban environment, *Frontiers in Public Health*, DOI: [10.3389/fpubh.2016.00132](https://doi.org/10.3389/fpubh.2016.00132), <http://journal.frontiersin.org/article/10.3389/fpubh.2016.00132/full>

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