Scent of the familiar: You may linger like perfume in your dog's brain

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A nose for neuroscience: Zen, a golden retriever involved in the study. Credit: Helen Berns.

An area of the canine brain associated with reward responds more strongly to the scents of familiar humans than it does to the scents of other humans, or even to those of familiar dogs.

The journal *Behavioural Processes* published the results of the first brain-

imaging study of dogs responding to biological odors. The research was led by Gregory Berns, director of the Center for Neuropolicy at Emory University.

"It's one thing when you come home and your dog sees you and jumps on you and licks you and knows that good things are about to happen," Berns says. "In our experiment, however, the scent donors were not physically present. That means the canine brain responses were being triggered by something distant in space and time. It shows that dogs' brains have these mental representations of us that persist when we're not there."

When humans smell the perfume or cologne of someone they love, they may have an immediate, emotional reaction that's not necessarily cognitive, Berns notes. "Our experiment may be showing the same process in dogs. But since dogs are so much more olfactory than humans, their responses would likely be even more powerful than the ones we might have."

In 2012, Berns led the team that captured the first brain images of alert, unrestrained dogs, using harmless functional magnetic resonance imaging (fMRI), setting the stage for exploring the neural biology and cognitive processes of man's best friend. He has shown that dogs have a positive response in the caudate region of the brain when given a hand signal indicating they would receive a food treat, as compared to a different hand signal for "no treat." In humans, the caudate region is associated with decision-making, motivation and processing emotions.

Berns conducted the scent research with Andrew Brooks, also with Emory's Center for Neuropolicy, and Mark Spivak, owner of Comprehensive Pet Therapy.

"Olfaction is believed to be dogs' most powerful and perhaps important

sense, making it an obvious place to explore canine social cognition," Spivak says.

Kady, a lab involved in the study, shown training for the experiment in a mock-up scanner. Credit: Helen Berns.

The experiment involved 12 dogs of various breeds. The animals had all undergone training to hold perfectly still while undergoing an fMRI scan. As they were being scanned, the subjects were presented with five different scents that had been collected on sterile gauze pads that morning and sealed in Mylar envelopes. The scent samples came from the subject itself, a dog the subject had never met, a dog that lived in the subject's household, a human the dog had never met, and a human that lived in the subject's household.

The familiar human scent samples were taken from someone else from

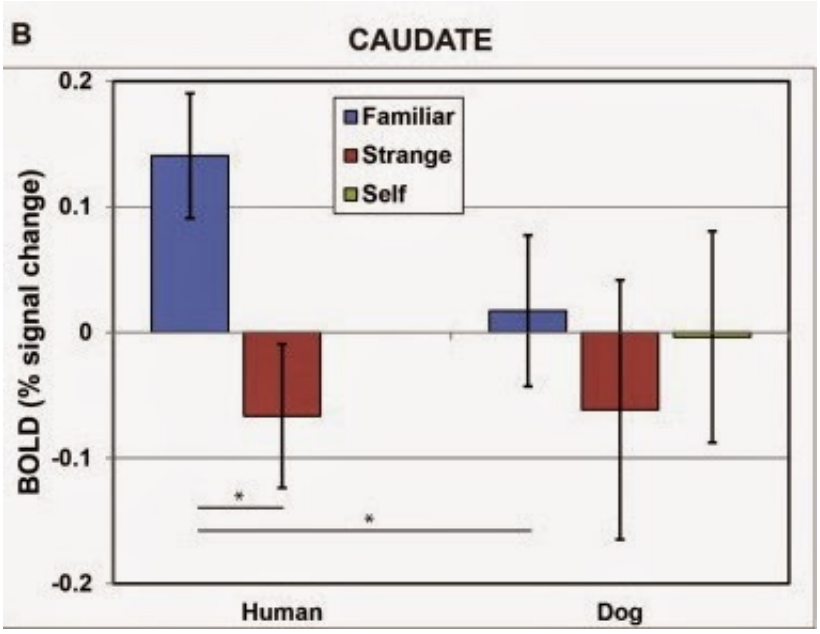
the house other than the handlers during the experiment, so that none of the scent donors were physically present.

The dog scents were swabbed from the rear/genital area and the human scents were taken from armpits.

"Most of the dog owners and handlers involved in the experiment were women, so most of the familiar human scent donors were their husbands," Berns says. "We requested they not bathe or use deodorant for 24 hours before taking the sample. Nobody was too happy about that."

Except for the dogs, apparently.

The results showed that all five scents elicited a similar response in parts of the dogs' brains involved in detecting smells, the olfactory bulb and peduncle. The caudate responses, however, were significantly stronger for the scents of familiar humans, followed by that of familiar dogs.



"The stronger caudate activation suggested that not only did the dogs discriminate the familiar human scent from the others, they had a positive association with it," Berns says. "While we might expect that dogs should be highly tuned to the smell of other dogs, it seems that the 'reward response' is reserved for their humans. Whether this is based on food, play, innate genetic predisposition or something else remains an area for future investigation."

An interesting twist: The dogs in the experiment that had received training as service/therapy dogs showed greater caudate activation for the scent of a familiar human compared with the other dogs. It is unclear whether this difference was due to genetics or had simply been fostered through the service/therapy training.

"We plan to do further research to determine whether we can use brain-imaging techniques to better identify dogs that are optimal to serve as companion animals for the disabled," Berns says.

The training of service dogs is time-consuming and expensive, he says, and only about one-third of the animals that begin the process successfully complete it. Meanwhile, the waiting list for service dogs is long, and includes many wounded veterans.

"In addition to serving as companion animals for wounded veterans, dogs play many important roles in military operations," Berns says. "By understanding how dogs' brains work, we hope to find better methods to select and train them for these roles."

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