

Study links fox domestication to gene activity in the pituitary gland

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A new study finds stress-response differences in the brains of foxes bred to be more or less aggressive toward humans. Pictured here is a tamed fox (*Vulpes vulpes*). Credit: Darya Schepeleva

A study of foxes offers new insights into the brain changes that occur in wild canids as they become more tame, researchers report. The study links fox domestication to changes in gene activity in the pituitary gland, a brain center that kicks out hormones to regulate various bodily functions, including the stress response.

The study, published in the journal *G3: Genes | Genomes | Genetics*, adds to a growing body of evidence suggesting that domestication alters animals' reactivity to [stress](#).

"Other studies have seen a relationship between tameness and stress responses in animals," said Jessica Hekman, the first author of the paper who worked on the study as a graduate student in the laboratory of University of Illinois animal sciences professor Anna Kukekova. Hekman is now a postdoctoral researcher at the Broad Institute of MIT and Harvard. "In particular, the characteristic reduction in fearfulness of domesticated animals is closely linked to reductions in blood levels of ACTH, a hormone released by the anterior pituitary gland that, among other things, drives the [stress response](#)."

To get a better view of how this might occur, the researchers looked at [gene activity](#) in the anterior pituitary glands of foxes in a [breeding program](#) at the Institute of Cytology and Genetics in Novosibirsk, Russia, designed to study the evolutionary processes associated with domestication. They compared six foxes selectively bred for tameness and six foxes selectively bred for aggression.



Postdoctoral researcher Jessica Hekman, pictured here with her dog, studies canid behavior and evolution. Credit: Alonso Nichols/Tufts University

"Previous studies have found that ACTH levels in the anterior pituitary do not differ between tame and aggressive fox strains," Kukekova said. "This means that differential expression of the gene encoding ACTH may not cause the differences seen in [blood levels](#) of this [hormone](#), and some other mechanism is reducing ACTH in the bloodstream of tame foxes."

"Our analysis revealed that the differences between tame and aggressive foxes may lie in cells in the anterior pituitary gland, which can change

their shapes to communicate with one another about when it's time to release stress hormones," Hekman said. "Their pituitary glands may produce the same amount of [stress hormones](#) but be less efficient at getting those hormones into the bloodstream."

"If confirmed, our finding could help explain why tame foxes are not stressed so easily as foxes that have not been selected for tameness," Kukekova said.

More information: Jessica P. Hekman et al, Anterior Pituitary Transcriptome Suggests Differences in ACTH Release in Tame and Aggressive Foxes, *G3: Genes|Genomes|Genetics* (2018). [DOI: 10.1534/g3.117.300508](#)

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