

ERIN HECHT, BRAIN-BEHAVIOR EVOLUTION IN DOMESTIC DOG BREEDS AND THE RUSSIAN FARM-FOX EXPERIMENT

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How do organisms evolve new adaptations to their behavioral repertoires?

Domestication offers a unique window into this question because it involves strong, sometimes intentionally-applied selection pressure on a focused set of behaviors. This talk will describe three studies on brain-behavior evolution in selectively-bred canines. The first study compared brains of tame, aggressive/avoidant, and control foxes from the experimental domestication project at the Institute of Cytology and Genetics at Novosibirsk in the Russian Academy of Sciences. In this program, animals are bred solely based on their social approach/avoidance behavior toward humans. We used a 9.4T MRI to scan fixed brains of 30 foxes at a resolution of 300 cubic microns, acquiring T1, T2, and DTI images. Analyses revealed changes to prefrontal-limbic networks – surprisingly, sometimes in the same direction for tame and aggressive foxes. A second study analyzed MRI scans in domestic dogs. We identified significant differences in regionally covarying gray matter morphology networks across breeds. These networks appear to map onto breed-specialized skills such as hunting, herding, and guarding, suggesting that selective breeding by humans has had a significant effect on dog brain anatomy across breeds. In the third study, we examined the same dataset in relation to breed-average temperament measurements as indexed by C-BARQ. This revealed that brain phenotypes across dog breeds can also be linked to traits like fear, aggression, and trainability. Together, these results are relevant for understanding general mechanisms of brain-behavior evolution and the specific mechanisms underlying evolved changes in behavior in domesticated canids.

Dr. Erin Hecht directs the Evolutionary Neuroscience Laboratory in the Department of Human Evolutionary Biology at Harvard University. Her research asks how brains change in response to selection pressure on behavior, and how brains acquire heritable adaptations for complex, learned behaviors. One line of work is focused domestic dogs and selectively-bred foxes, which are other highly encephalized, social species. Another area of research compares brain-behavior relationships in humans and our primate relatives. Techniques include structural and functional neuroimaging, behavior measurements, histology, and microscopy. Before joining the faculty at Harvard, Dr. Hecht was a Research Scientist in the Center for Behavioral Neuroscience at Georgia State University, and an Affiliated Scientist at the Yerkes National Primate Research Center at Emory University. Dr. Hecht received her B.S. in Cognitive Science from the University of California San Diego in 2006, and her Ph.D. in Neuroscience from Emory University in 2013. She has two dogs, Lefty and Izzy, who are *mostly* good.

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