Researchers find low genetic diversity in domestic ferrets

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A new paper showing that pet domestic ferrets are inbred and have low genetic diversity appears in the online journal *Evolutionary Applications*. Credit: Robert Church

University of Wyoming researchers studied inbred domestic ferrets and

determined the mammals have low genetic diversity on a global scale, according to a paper recently published in *Evolutionary Applications*.

This type of domestication can result in only a few individuals contributing to the gene pool of the domestic species, followed by a further reduction in genetic diversity when animals are bred for human-desired traits. Without genetic diversity, animals are at risk of genetic disorders and disease.

"Low genetic diversity in ferrets has incredibly important implications, because the ferret is now a common pet, a laboratory model organism for diseases such as influenza and SARS, and ferrets that have become feral can negatively impact native species and ecosystems," says Kyle Gustafson, a UW postdoctoral conservation geneticist. "Previous studies have shown artificially breeding for specific ferret coat colors can be associated with genetically determined physical abnormalities. Additionally, the mechanism for increasing cancer rates in pet ferret populations is currently unknown."

Gustafson, of Perham, Minn., was lead author of a paper, titled "Founder Events, Isolation and Inbreeding: Intercontinental Genetic Structure of the Domestic Ferret," that appeared in the Oct. 23 online publication *Evolutionary Applications*, a fully peer-reviewed, open-access journal that publishes papers that utilize concepts from evolutionary biology to address biological questions of health, social and economic relevance.

Holly Ernest, a UW professor of wildlife genomics and disease ecology, and Wyoming Excellence Chair in Disease Ecology, was senior author of the paper. Other co-authors include Michelle Hawkins and Tracy Drazenovich, both from the School of Veterinary Medicine at the University of California-Davis; Susan Brown, a veterinarian from Rosehaven Exotic Animal Services in Batavia, Ill; and Robert Church of

BCPhoto in Columbia, Mo.

Gustafson, Ernest and Drazenovich completed the genetic component of this study. Hawkins and Brown helped design the study along with Church, a ferret expert, who traveled around the globe collecting DNA from domestic ferrets.

The study genotyped 765 ferrets (from 11 countries) at 31 genetic markers.

"It (study) definitely applies to any breeding program, whether in zoos or domestic cattle in Wyoming or elsewhere," Gustafson says.

Inbreeding is almost always a concern in zoos where animals are maintained at extremely low numbers. However, domestication events can result in similar losses of population genetic diversity. For example, pet ferrets, or *Mustela putorius furo*, were domesticated from wild European polecats and have been bred for specific traits, such as coat color and temperament. These domestic ferrets were transported from Europe to multiple continents and are now dependent upon humans for their survival.

Domestic ferrets are different from wild North American black-footed ferrets (*Mustela nigripes*), which experienced catastrophic population losses resulting from disease.

Researchers reported that the domestic ferrets in North America and Australia had extremely low genetic diversity, whereas ferrets in Europe had higher genetic diversity, as periodic hybridization with wild polecats appears to occur.

However, all the countries sampled had ferrets with lower genetic diversity than their wild ancestors.

"If low genetic diversity is a contributor to certain diseases, as has been shown in other systems, ferrets in Australia, Canada, New Zealand and the United States could be most at risk," Ernest says.

The majority of domestic ferrets contract cancer by age 5 or 6, but not all die at those ages, Gustafson says.

"Cancer in these ferrets was the underlying genetic issue that was the impetus for the study," he says.

The researchers recommend that breeding programs would benefit by incorporating genetically diverse ferrets from other countries into their breeding programs, including ferrets from Europe, where genetic diversity is much higher. However, international importation and exportation laws limit the potential for introducing new genetic material in some countries, such as Australia and New Zealand.

Thus, breeders should actively minimize inbreeding among ferrets in these countries. Further breeding programs should be cautious to ensure diseases are not introduced through international transportation.

"Pet ferrets could pose a risk to wild polecat species by introducing their poor genetic material into wild polecat populations," Ernest explains. "Any attempts to enhance the genetic diversity of ferrets by using wild polecats should be done ethically and legally, and should ensure that domestic ferrets do not breed into wild ferret or polecat populations."

More information: Kyle D. Gustafson et al, Founder events, isolation, and inbreeding: Intercontinental genetic structure of the domestic ferret, *Evolutionary Applications* (2017). DOI: 10.1111/eva.12565