

The genomic signature of dog domestication reveals adaptation to a starch-rich diet

Erik Axelsson¹, Abhirami Ratnakumar¹, Maja-Louise Arendt¹, Khurram Maqbool¹, Matthew T. Webster¹, Michele Perloski², Olof Liberg³, Jon M. Arnemo^{4,5}, Åke Hedhammar⁶ & Kerstin Lindblad-Toh^{1,2}

The domestication of dogs was an important episode in the development of human civilization. The precise timing and location of this event is debated^{1–5} and little is known about the genetic changes that accompanied the transformation of ancient wolves into domestic dogs. Here we conduct whole-genome resequencing of dogs and wolves to identify 3.8 million genetic variants used to identify 36 genomic regions that probably represent targets for selection during dog domestication. Nineteen of these regions contain genes important in brain function, eight of which belong to nervous system development pathways and potentially underlie behavioural changes central to dog domestication⁶. Ten genes with key roles in starch digestion and fat metabolism also show signals of selection. We identify candidate mutations in key genes and provide functional support for an increased starch digestion in dogs relative to wolves. Our results indicate that novel adaptations allowing the early ancestors of modern dogs to thrive on a diet rich in starch, relative to the carnivorous diet of wolves, constituted a crucial step in the early domestication of dogs.

¹Science for Life Laboratory, Department of Medical Biochemistry and Microbiology, Uppsala University, 75237 Uppsala, Sweden. ²Broad Institute of Massachusetts Institute of Technology and Harvard, Cambridge, Massachusetts 02139, USA. ³Grimsö Wildlife Research Station, Department of Ecology, Swedish University of Agricultural Sciences, 73091 Riddarhyttan, Sweden. ⁴Department of Forestry and Wildlife Management, Faculty of Applied Ecology and Agricultural Sciences, Hedmark University College, Campus Evenstad, NO-2418 Elverum, Norway. ⁵Department of Wildlife, Fish and Environmental Studies, Faculty of Forest Sciences, Swedish University of Agricultural Sciences, 901 83 Umeå, Sweden. ⁶Science for Life Laboratory, Department of Clinical Sciences, Swedish University of Agricultural Sciences, 75651 Uppsala, Sweden.