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Survival of the friendliest

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More than forty million Americans cherish their tail-wagging, face-licking, ball-fetching best friends. But not many people would welcome a wolf into their home. What makes dogs so uniquely friendly? Scientists have studied the unique relationship between humans and domestic dogs for decades, but the role of genetics in shaping canine sociability remains poorly understood. In a new study published July 19th, 2017 in the journal Science Advances, we identified genetic changes that are associated with overt friendliness in domestic dogs. These genetic changes are in the same genes that cause Williams-Beuren Syndrome (WBS) in humans. WBS is a rare genetic disorder with a range of symptoms. However, perhaps the most striking symptom of WBS is hypersociability. In our study, we found that dogs share very similar features in their hyper-social behaviors towards humans as people with WBS. When canines were presented with a problem-solving task in the presence of a human, wolves typically complete the task quickly. However, domestic dogs paid much of their attention to the human instead of solving their task, even clamor for human attention when the human is ignoring them. Dogs also engaged in prolonged greetings with humans, whereas wolves are quick to return to their individual activities.

Our study also identified a shared genetic basis between WBS humans and canines. The mutations we identified that contribute towards this hyper-social behavior are not rare. In fact, these mutations are called transposons and are found throughout the dog genome. Transposons are bits of DNA that replicate independently from the rest of the genome and transpose (hence "transposon") themselves into new locations - sometimes with a dramatic impact on a gene's function. In the case of dogs and hypersocial behavior, a few transposons have randomly inserted themselves into three genes that appear to be crucial in shaping social behavior in both dogs and their human companions. We found that transposon insertions into these genes (named *WBSCR17*, *GFT2I*, and *GTF2IRD1*) were strongly associated with the tendency for dogs to seek out interactions with humans. However, in humans, it is the deletion of these genes, rather than insertions, that causes WBS.

Our findings provide a possible story for how humans domesticated wolves into dogs, which is suggested to have been through "the survival of the friendliest". Darwinian evolution is the survival of the fittest, meaning that individuals bearing the traits that are most fit for that environment at that particular time have the benefit of surviving to produce offspring with those traits. These traits can by complex, such as behavior. As such, we present the hypothesis that the wolf ancestors that carried these mutations were friendlier towards humans than ancestor wolves that lacked those mutations. This provided them new benefits, like the ability to scavenge for food near human civilizations, helping them survive and reproduce. Many of their offspring would also have inherited these mutations, possibly increasing their friendliness towards humans until the day that humans began keeping these early dogs as pets. With that, humans became their first owners and these first dogs were the founders of our very

own canine companions.

These findings not only provide an insight into the history of how wolves "became" dogs, but also provide us with information about how we can care for our modern dogs. In the absence of background information about an animal, shelters often use behavior assessments to make decisions about adoptability. However, these assessments are not perfect. The reaction of an anxious or fearful dog may not accurately represent home behavior. Likewise, significant time and resources are often dedicated to training service dogs, where either excessive or insufficient sociability can result in failing out of the training program, which can be as high as 50%. Because behavior is a complex mixture of genetics, development, and environment, one potential application of this new discovery is the ability to identify genetic predispositions for hyper-social behavior. This knowledge could aid in adoption, work placement, and training efforts. Consequently, it could be very useful to know if dogs carry one or more of these mutations, which could greatly complement the behavior assessment tools currently in practice. While more research into these potential applications is needed, these findings hold great potential for teaching us more about how dogs became one of our closest companions, and how we can improve the health, welfare, and bonds we share with our dogs today.