

Why dogs can teach humans about healthier ageing

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Living with people means that dogs and humans experience similar social and environmental influences on a daily basis. Credit: Alvan Nee/Unsplash

Our pet dogs could help extend human lives beyond their documented effects on people's wellbeing. Increasingly, studies are looking at how

the domestic dog, *Canis familiaris*, is key to understanding cognition and processes involved in ageing—something that could improve both animal and human wellbeing.

"In recent years, the dog has grown to be one of the most important animals for researchers who aim to understand the biological background of complex traits," said Dr. Enikő Kubinyi, an ethologist at Eötvös Loránd University in Budapest, Hungary.

Previously, [dogs](#) weren't considered good model for studies into animal behaviour as they were thought to be an 'artificial species' that have been shaped by humans. But this view has changed over the past 25 years, says Dr. Kybinyi.

A key driver has been her university's [Family Dog Project](#), founded in 1994 on the principle that the family home is dogs' natural environment due to their adaptations over many thousands of years to live with people.

Now one of the world's largest dog research groups, the initiative was expanded in 2016 with the [Senior Family Dog Project](#), or [EVOLOR](#), to look specifically into [cognitive ageing](#). And Dr. Kubinyi, who is the principal investigator on the project, says dogs have a number of key advantages as an ageing model for humans over apes and traditional lab animals such as rodents.

For a start, living with people means that dogs experience near-identical social and environmental influences on a daily basis. They are also susceptible to many comparable age-related diseases, such as a form of dementia similar to Alzheimer's, [which mice do not naturally develop](#).

In addition, the rapid rise in [big data](#) and citizen science, in which members of the general public contribute to scientific projects, means

that it has become much easier to get people to volunteer their pets for participation, says Dr. Kubinyi—with EVOLOR having collected data via both behavioural tests and surveys on more than 20,000 dogs.

"When we started the project, we established a group for devoted owners who promised to come to the lab several times every year, and we collected longitudinal data about those dogs," she said.

Ageing

Though final data is still being analysed, the findings during the project further backed up dogs' usefulness as a wide source of insight into ageing.

"Our results support the dog's potential as a model of cognitive ageing and provide knowledge for increasing the quality of life of dogs and owners alike," she added. "We found age-related differences in [brain activity](#), cognition, personality, the gut microbiome, gene expression and gene variants in several aspects similar to human ageing ... We've found parallels time after time."

Looking into behavioural changes in a recent [study on 217 Border collies](#) aged six months to 15 years, the team, together with the Clever Dog Lab in Austria, found similarities with humans in the dogs' possession of both malleable and stable personality traits as they age, along with varying trajectories between traits.

For example, the dogs' interest in problem-solving tended to rise until middle age—about three to six years—before levelling off, while novelty-seeking changed little until middle age and then steadily dropped. Conversely, like in humans, personality traits stayed fairly stable between dogs: for instance, young dogs that were most active tended to remain so when older.

The team has also found that old dogs seem to experience a similar 'positivity effect' to older people, [reacting less to negative sounds such as crying than positive ones such as laughter](#).

"I have a 13-and-a-half-year-old labrador, and when I say "come here," she just doesn't listen to me. But when she hears me move her box of food, she comes immediately," said Dr. Kubinyi. "Old dogs seem to listen to what they want to hear... In humans, old people are more attuned to [positive emotions](#) and less to negative emotions."

Genetic links

As well as looking at behavioural aspects of ageing, the project is looking into processes at a molecular level and establishing a basis for understanding the specific underlying neural and genetic links to ageing—including through methods such as EEG (electroencephalography), fMRI (functional magnetic resonance imaging) and genetics tests.

One study backed up the analysis of [activity patterns in sleeping dogs' brains](#) as a biomarker of cognitive ageing across species; another found that better canine performers in memory tests tended to have [lower levels of certain Actinobacteria in their gut](#), mimicking some observations in people with Alzheimer's disease. "This is preliminary research, but there were parallels with human research again," said Dr. Kubinyi, adding that it could also shed light on the best types of diet to keep dogs healthy as they age.

And on the genetics side, by analysing the whole genome sequence of two mixed-breed canines aged 22 and 27—far older than the average dog lifespan of about 10 to 13 years, and dubbed "Methuselah dogs" after the long-lived biblical figure—the researchers identified [more than 80,000 novel genetic mutations compared with 850 dogs of normal](#)

[lifespan](#).

Dr. Kubinyi said that much knowledge is still needed on the genetics of dog cognition, but EVOLOR is currently analysing data it has gathered from young and old dogs over the past four years that it hopes will reveal much more. It has already found genetic markers for ageing in the blood and brain, as well as collecting DNA for analysis from additional Methuselah dogs.

One of the keys to future research is EVOLOR's recent establishment of a [Canine Brain and Tissue Bank](#), a repository for ongoing study formed by collecting samples donated by owners of euthanised [pet dogs](#).

Among those already making use of this is the [Dog Aging Project](#) at the University of Washington in Seattle, US, for looking into areas such as the degree to which cognitive decline in dogs is associated with increased levels of key proteins linked to Alzheimer's disease in people.

Pet canines

The project, which describes itself as the largest-ever study on ageing in dogs and which started in 2019, reflects how this area of research is taking off. Over the next decade, it will follow tens of thousands of pet canines.

The involvement of many owners interested in volunteering their dogs will enable extensive data collection, offering more insight into ageing-based influences than possible through lab research, says Professor Evan MacLean, an evolutionary anthropologist working on the project. '(This participation) is going to allow us to ask questions that would be impossible using traditional laboratory approaches,' he said.

He added that the kind of multidisciplinary research in the Dog Aging

Project and EVOLOR, combining behavioural, physiological, neurobiological and genetic research, will 'surely lead to important insights about healthy ageing in both dogs and people.'

Professor Daniel Promislow, co-director of the project, says the existence of many hugely varying breeds of dog will allow significant insight into the effect of size on healthy longevity and susceptibility to different diseases. It should also give some clues about why larger breeds tend to be shorter-lived, opposite to the usual pattern seen across species of mammals.

"We don't know for sure why that is, but we will certainly be able to shed light on this question," said Prof. Promislow. "And given that dogs are so much shorter-lived than humans, we should be able to identify the genetic and molecular pathways associated with ageing diseases faster."

In addition, the project is looking to boost insight on the effects of rapamycin—a drug originally developed to prevent rejection of organ transplants, but that has often been shown to slow ageing in animals.

Neural mechanisms

Professor Kun Guo, a cognitive neuroscientist at the University of Lincoln, UK, says that although we now have a decent amount of knowledge about dog perception and behaviour, some aspects of cognition research will take time because we currently know little about the underlying brain or neural mechanisms.

However, things look promising for the long term, he says. "The long history between humans and dogs may promote co-evolution of certain cognitive abilities, hence dogs are an ideal animal model for this line of research," he said.

Prof. Guo's own team is looking into dogs' broader emotional functioning and how they respond to people's emotional signals in the [EMOMETER](#) project, though he says the researchers are sifting through and analysing all the data collected, so it is too early to discuss the results.

Nevertheless, he says studying dog cognition will bring multiple benefits for improving both their own and our wellbeing. "Given that dogs play important and multifunctional roles in our society, appropriate understanding of their cognitive capabilities and constraints would allow us to have a realistic expectation of dogs and help ensure their welfare."

And Professor Stephen Lea, a psychologist at the University of Exeter, UK, said that recent longitudinal studies provide a new opportunity to investigate the effects of domestication on the evolution of cognition.

Quite aside from that, he said, it is hugely important for us to be able to see more eye-to-eye with our pets so we can take better care of them: "We have a moral responsibility to ensure that the animals we choose to keep are happy."

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