

The Science of Living Longer

Everyone wants their dogs to live longer and healthier lives. The good news is biologists are working on it.

BY LIZ VACCARIELLO

I remember the exact moment it hit me that my dog, Milo, was getting old. We were taking our daily walk, stopping to greet friendly dogs and their humans. The encounter started the same way a hundred conversations before it had: "Hi, this is Milo." "Hi Milo, this is Gus. What kind of dog is Milo?" I ran through his mutt-mix of mostly hound, some bulldog and Labrador—even a bit of chow, which might explain his short legs.

As our dogs circled and sniffed, Gus's owner asked his age. Milo had just turned eight. "Ohhh!" she said, fixing her mouth and eyebrows into positions of sadness and worry. "Time flies, right? He looks great for a senior."

I haven't looked at Milo the same way since. Now, I search his snout for signs of gray (none yet), take him in for every cyst or bump, and worry if he jumps less than enthusiastically into the back seat (arthritis?). Good thing we have a wonderful veterinarian we now see twice a year who compliments Milo's healthy weight and clean teeth and gums—and pronounces him to be "in perfect health."

I'm not morbid, worrying about Milo's longevity. Having a sense of a dog's potential life span lets us prepare in plenty of time for their needs as seniors. Generally, small dogs live longest (10 to 15 years). The giant breeds—Great Danes, German shepherds—tend to have shorter life spans and are considered senior by age seven. At 65 pounds, Milo is considered large. Large dogs enter their "senior years" at the age of eight to nine and live about 12 years.

While it's heartbreaking to think of our canine companions as being anything less than happy, pain-free, and content, it's heartening to know that scientists are on the case.

As it turns out, companion dogs and humans share approximately 85 percent of the same DNA. Dogs have also been intimately associated with people for more than 11,000 years and have become susceptible to some of the same conditions, like heart and kidney disease, blindness, melanoma, osteoarthritis, even dementia. Treatments that benefit canines might therefore apply to humans, and the National Institutes of Health helps to fund research into treatments for dogs.

In addition, a dog's short life cycle allows scientists to more



Author Liz Vaccariello walks Milo on a three-mile loop several times a week in a nature reservation near their home in South Orange, New Jersey.

swiftly study their biology throughout their whole life span, even across several generations.

All of these factors have led to a boom in the field of dog longevity and senior care. “Ten years ago, there wasn’t much,” says Dr. Matt Kaeberlein, a canine biologist and the director of the Healthy Aging and Longevity Research Institute at the University of Washington, in Seattle. “But within the last

five years there’s been a dramatic increase in the breadth and the depth of academic groups and companies looking at the biology of aging in dogs.”

Three high-profile projects provide a glimpse into the booming field of canine aging and longevity. Their findings can impact Milo’s senior years—and give us all insights into how our pets can live longer and healthier lives.

Biologists at Work

One such effort is the search for a canine “miracle pill” that extends life. Loyal, a biotech company founded in 2020 and funded almost entirely by Silicon Valley venture capital, got FDA approval in early 2023 to stage clinical trials on two drugs. Neither treats disease. As founder Celine Halioua explains, Loyal’s drugs activate some of the same metabolic pathways that a

calorie-restricted diet activates. In theory, this could add years of healthy life to dogs.

That's exciting news for me—and other dog owners like Kaeberlein, who tells me, "I'm one of the 50 percent or so of people who consider dogs to be part of the family." Back in 2014, he began the most far-reaching and ambitious canine health study ever done. It's called the Dog Aging Project (DAP). And it brings together researchers from various U.S. institutions, so-called citizen scientists (dog owners who provide data on their dogs), and the more than 45,000 members of the DAP pack (the dogs enrolled in the study).

"Researchers had done dog life span studies with dogs maintained in lab conditions," says Kaeberlein, the codirector of DAP. "One focused on calorie restriction and another tested a drug in beagles. But the DAP gathers data from dogs of all ages and breeds—puppies, big and giant dogs, rural dogs, working dogs, purebreds, and mutts—that are living in homes with their companions. That way we can study the lifestyle and environmental factors at play."

The DAP team of 40-plus researchers works out of the University of Washington. (Another of its founders, Kate Creevy, DVM, is affiliated with Texas A&M University.) Naturally, Kaeberlein enrolled his own 12-year-old German shepherd, Dobby. But most dogs participate without ever leaving their couches.

I signed up Milo, which meant spending about three hours filling out an annual 116-page questionnaire that covers everything from diet and mobility to temperament, favorite types of toys, bowel habits, pesticide exposure, health status,

and sleeping arrangements. The intake form also includes questions such as, How often does your dog walk into walls or doors? How often does your dog have difficulty finding food dropped on the floor? Environmental data, like air and water quality, is correlated to each dog's geographic location. And more than 15,000 participants have also uploaded their dogs' veterinary records. The study is open-sourced, so researchers all over the world can interpret the data.

One study published in *Scientific Reports* looked at the effect of exercise on brain health, specifically focusing on canine cognitive

disorders," wrote University of Arizona researcher Emily Bray, who was careful to note the study's inability to infer causation. "There are many reasons why dogs with worse health might be fed more frequently [e.g., to take meds]."

Five hundred DAP dogs are also enrolled in a clinical study to explore whether the drug rapamycin can improve health span, the number of years a dog lives disease-free. Rapamycin is widely prescribed for humans to prevent organ rejection after a transplant and increases the life expectancy of middle-aged mice by as much as 60 percent. DAP will test the effects



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dysfunction (CCD), the dog version of Alzheimer's, known as doggy dementia. Among dogs of the same age, health status, breed, and sterilization status, odds of developing CCD were 6.47 times higher in dogs who were not active compared to those who were very active.

A team at University of Arizona used DAP's open-sourced data to look at intermittent fasting. They discovered that adult dogs in DAP who were fed only once per day tended to score significantly better across several indicators of health, compared with dogs fed more often. "They had lower odds of having gastrointestinal, dental, orthopedic, kidney/urinary, and liver/pancreas

of the drug on cognitive function, heart function, immunity, and cancer incidence.

"We're still recruiting dogs for the study, and there are no restrictions at all," emphasizes Kaeberlein. "Because of our title, people think we only want senior dogs. But we're keen to get puppies, too."

Science with Sled Dogs

In 2018, 103 retired sled dogs between the ages of eight and 11 arrived by car, bus, van, and plane to the Cornell University campus in New York. They came from kennels as far away as Fairbanks, Alaska, and as close as Lodi, Ohio, to be part of something called the Vaika Project.

Vaika is another longitudinal study on the mechanisms of aging in canines, with a specific focus on a drug that treats DNA damage.

Heather J. Huson, PhD, Vaika researcher and associate professor of genetics at Cornell University, and DJ Erb, the lead technician on Vaika, can't hide their love for the dogs (and the science) when describing their project. "I will ask anyone to get off a couch so a retired sled dog can sit on that couch," says Erb, a 31-year sled dog trainer and musher.

Some Vaika dogs are champions who participated in the Iditarod and other high-profile races. Some look like huskies, others resemble hounds, and a few even look like Milo, my mixed breed. All of them

have retired from racing, and they are living out their lives in a specially designed 8,254-square-foot kennel located on the Baker Institute campus of the College of Veterinary Medicine at Cornell University. They receive state-of-the-art veterinary care from Cornell faculty.

Long term, the scientists want to learn how to impact something called the retrobiome. "There's this ancient thing where viruses over time have joined their DNA to dogs' DNA," explains Huson. "Often that's not a problem. But as people (and canines) age, these viruses can activate and, along with weakening immune systems, can cause progressive frailty and symptoms of aging such as arthritis, inflammation,

and higher risk of cancer."

Doggy dementia is seen in 20 percent of dogs over the age of 11, so it's important to monitor cognitive dysfunction. Huson says it can lead to other changes, such as alterations in sleep-wake cycles, which can snowball into more significant problems. "I have eight dogs at home," says Huson. "Two of them are 14 and 10. As humans, we are aware that our dogs are old, but we don't see or look for the early signs of Alzheimer's, which are the same as in humans."

Every nine months, the Vaika team monitors each of the 104 dogs individually in a room via webcam, noting the way they explore an empty space, play with toys in the room, approach and interact with a human sitting in a chair who is not paying attention to them, navigate around a V-shaped child gate where they can see food on the other side, and so on. Over time, they note the changes in each dog's interest, energy, and abilities. Data already shows a link between brain health and exercise: The retired sled dogs that are on a more active testing regimen have shown slower cognitive decline.

The dogs in Vaika are monitored and cared for until their last days. "It's an important time for our research," says Huson. "Every dog gets a full necropsy. But it's also an emotional time for everyone who works on this project. We honor each dog for its contribution."

That includes placing paw prints of deceased dogs on a memorial wall and a special ritual led by project tech DJ Erb. "Each year," she says, "I return to Minnesota to handle sled dogs for my best friend. I bring hair from any of the dogs that have passed away, and I take them on their final run." 🐾

Keeping your dog's weight in line with the average weight for their breed can increase a dog's life span by six months to more than two years, when compared to their overweight counterparts.

