

Podcast script: Dogs Shed Light on Chemical Exposures and Disease

[Intro music]

Ashley Ahearn (Narrator): You're listening to Environmental Health Chat - a show from the National Institute of Environmental Health Sciences that explores the connections between our health and our world.

I'm Ashley Ahearn.

Most of us have been spending more time with our pets since the pandemic took hold.

Heather Stapleton has a 2-year-old Bernedoodle – that's a Bernese mountain dog/poodle cross – named Bella.

Heather Stapleton: Yes, she's adorable. She's cute. She certainly has enriched our lives and she has made our time through the pandemic, much easier to handle. I think it certainly alleviates a lot of the stress by having her here without a doubt.

Ashley Ahearn: Stapleton isn't just a happy dog owner, though. She's also a professor of environmental health and exposure science at the Nicholas School of the Environment at Duke University.

She studies the chemicals we're often exposed to in our daily lives and how they might affect our health. Things like flame retardants, plasticizers, PCBs, pesticides, volatile organic compounds. Chemicals found in our building materials, cosmetics, cleaning supplies, and other household goods.

Heather Stapleton: In reality, there's 1000s of different chemicals that are present in dust particles in our home, which can be kind of frightening for the average person. But really, what's important is to understand what those chemicals are, and if they reflect a risk for adverse health outcomes.

Ashley Ahearn: And Stapleton sees dogs – like her Bella – as a potential goldmine of data on her quest to answer that question.

Heather Stapleton: Dogs have a lot of shared environmental exposures with their owners and with people in general. And they have a more compressed lifespan.

Ashley Ahearn: Meaning that if a human and a dog are exposed to the same harmful chemical, the health effects of that chemical may be evident in a dog more quickly because their bodies age faster than ours. Of course, I'm referring to the whole "one human year equals seven dog years" idea here.

So, take cancer, for example.

Heather Stapleton: We know there are some cancers that do occur in dogs that have very similar phenotypes to cancers that occur in humans. And so there's an opportunity here for us to understand what's driving cancers in dogs and see if that can help inform us about what might be driving cancer risk in humans.

Ashley Ahearn: Stapleton has mainly focused on humans in her research, so she teamed up with an expert on cancer in dogs.

Matthew Breen: I think I've had an interest in dogs since I was a small child, my family always had dogs. And when I went to university, I became aware that, just like people, people's pet dogs also get cancer.

Ashley Ahearn: Matthew Breen is a professor of genomics at the North Carolina State University College of Veterinary Medicine.

Stapleton didn't have a tough time selling him on the value of studying dogs to better understand what we humans might be exposed to – and how those exposures could affect our health.

Matthew Breen: They share our home environment. We breathe the same air, we drink the same water, sometimes we eat the same food, we sit on the same couch. And when we're outside, throw a ball across the park, it's the same herbicide, insecticide-treated grass that we kids, grandkids, run across. So, the extent of our shared environment means that our dogs are perhaps what we would refer to as the best sentinel species we have for exposure-related human diseases, including cancers. We used to have canaries in the coal mines. Now we have canines on the couch.

Ashley Ahearn: The human and dog genomes are also remarkably similar. Scientists don't fully understand the causes of many cancers. There's believed to be a large genetic component, Breen said.

Matthew Breen: But not everything about cancer has to be related to genetics, we can't explain it all by genetics alone. So, it does suggest that our environment may also be contributing to the disease etiology, or certainly the interplay between genetics and our environment.

Ashley Ahearn: One of the biggest challenges in identifying the causes of cancer – in both humans and dogs – is quantifying our environmental exposures, and then connecting that exposure to the cancer diagnosis.

That's where the research partnership between Heather Stapleton and Matthew Breen gets interesting.

You know those silicone bracelets that got popular a few years ago when famous people like Lance Armstrong started wearing them? Well, Stapleton says you might also think of those bracelets as a sort of fly paper – chemicals in our surrounding environment basically stick to the silicone – giving scientists a snapshot of what we're exposed to in our daily lives. And some of those chemicals aren't just found on the wristbands.

Heather Stapleton: What accumulates on a silicone wristband is significantly correlated with biomarkers of exposure in blood and urine. Suggesting they work really well for capturing relevant exposures that are integrated over time – so while you're wearing them.

Ashley Ahearn: A group at Oregon State University had first pioneered using silicone as an exposure data gathering method back in 2014 and Stapleton and Breen wanted to test the idea out by studying humans and dogs.

Heather Stapleton: So basically, what we did is we cut up little pieces of wristbands and attached them to a key chain that could be put on the dog's collar. And we recruited, it was just basically a convenient sample of dog owners in the area, and asked them if they would attach one of these small pieces of a silicone band to the collar of their dog for a week.

Ashley Ahearn: The owners also wore a silicone wristband and agreed to collect urine samples from themselves – and their dogs – over the course of the week.

Then, Stapleton and her team analyzed the silicone bracelets and tags and compared the chemicals they found there with the chemicals they found in the human and dog urine samples.

Heather Stapleton: And sure enough, just like in people, we saw this association. So what we measured on the dog collar was correlated with the biomarkers that we measured in the dog's urine. And in fact, many of those relationships were stronger in the dog than they were in the human.

Ashley Ahearn: The study, which was funded in part by NIEHS, also confirmed their hypothesis that chemical exposures were very similar between dogs and their humans. In one example, Stapleton said a person told them they had sprayed DEET to keep away bugs during the week of the study. The DEET showed up in both the human and dog urine samples.

Stapleton and Breen published a paper with their results a year ago. It was a pilot study – a proof of concept – that they're excited to expand.

Heather Stapleton: And so we see this as a really exciting opportunity then to understand more about how these environmental exposures could be contributing to cancer risk.

Ashley Ahearn: Stapleton and Breen are now conducting a larger, longer-term study to follow 200 people and their dogs over the next two years – and hopefully beyond – if funding is extended, Breen said.

Matthew Breen: Our overall goal is to assess what chemical exposures are detectable that are shared by dogs and humans, and then correlate those over time to determine if there is an impact on the dogs that may indicate a potential increased risk to humans over an extended period of time. But remember, the impact of many exposures on humans is not realized for many, many years. But we may see the evidence in dogs over a much shorter timeframe. So if we're able to identify changes in the health of dogs, we will have time, we should have time to mitigate the potential risks.

Ashley Ahearn: Specifically, Breen wants to look at bladder cancer in dogs. It's not the most common type of canine cancer – 50,000 to 100,000 dogs are diagnosed with it each year in the U.S. – but it shows up pretty similarly in humans. It's also possible to detect it in urine samples, through molecular analysis.

And, Breen says, they're homing in on one potential chemical exposure that could be at least partially to blame for bladder cancer...

Matthew Breen: There are several human studies that have looked at exposure to a what are called water disinfection byproducts, or DBPs, and organophosphates, which in humans are believed to be associated with bladder cancer. So we're also collecting water samples from these bladder cancer patients in dogs to see whether there's also an association in dogs and these disinfection byproducts.

Ashley Ahearn: The hope, though it's a bit morbid, is that Stapleton and Breen can find an association between those chemicals and bladder cancer in dogs – and that evidence could be used to keep both humans, and dogs, safer in the future.

Matthew Breen: So I think my overall goal for this is to really start to push forward discoveries or accelerate, if you like, discoveries in human cancer by addressing cancers in dogs. So not only do we benefit the dogs in our household by developing new therapies for them, at the same time, we're also advancing what could potentially happen to address a situation in our human family members.

Ashley Ahearn: Breen and Stapleton are in the midst of their research now – and have faced some challenges and delays due to the pandemic. They're looking forward to building out the study in the coming year, and including outreach to their study participants in the form of newsletters and other helpful information. They see their research collaboration as citizen science that can hopefully help dog owners and non-dog owners alike in reducing their potentially dangerous exposures in the future.

Heather Stapleton: Certainly where there's an opportunity to reduce our exposure and mitigate risk, I think we should try to take those steps, right, if we have choices about the products we buy, that maybe do not have these chemicals, I think that's important for us to know.

Ashley Ahearn: Stapleton also suggested, installing air filtration systems and using wet mops instead of brooms to reduce dust particles that can contain chemicals.

So, in listening to all this, you might be wondering – Ok, if I have a dog and that dog gets cancer, am I going to get cancer?

Matthew Breen: And the answer is, we really don't know. All we know is that we are detecting more cancers in dogs now than previously, we're detecting more cancers in people than we were previously.

Ashley Ahearn: Breen was careful to add that that's likely, in part, because humans and dogs are getting better health care these days and we're detecting cancer more effectively. He sees that as an opportunity, if a cancer is detected earlier, to limit harmful exposures and seek treatment. But ultimately, Stapleton and Breen agree...

Matthew Breen: Just because a dog develops a particular kind of cancer does not mean that the family members in that household will also develop the same or even a different type of cancer. They're not necessarily connected, until we can figure out why the cancers were forming in the first place.

Ashley Ahearn: Breen has been working with dogs and cancer for 30 years. He gets calls every week from dog owners who are facing the loss of their best canine friend. It's hard, emotional work, but he says but he's inspired by those phone calls.

Matthew Breen: And what always strikes me, is dog owners somehow seem to find the courage to overcome their own distress, and arrange for a biological sample and clinical information to be sent to our lab so that we can include their dog in one of our studies. I am persistently, constantly amazed by the community spirit. So even when people can't help their own dog, the American public is very eager to do what they can to help us with our research. And when I ask them, How do you find the courage to do this? It's always the same answer. They faced tragedy through the loss of their own dog or are about to, and they'd want to do whatever they can, so that other families do not have to face a similar situation with their own dog in the future.

Ashley Ahearn: There are more than 80 million dogs in more than 50 million households in the U.S., Breen said. During the pandemic we're spending more time with our pets than ever before - and may continue to do so in the future, as more people work from home.

The silver lining, if you ask Heather Stapleton and Matthew Breen? A bonanza of data about canine and human environmental exposures that could help keep us all safer in the future.

The two hope to expand their study to include more dogs, and their owners, across the country in the coming years.

I'm Ashley Ahearn. Thanks for listening to Environmental Health Chat.

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