

ONE HEALTH: ADVANCING CANINE AND HUMAN HEALTH



THE ONE HEALTH CONNECTION between dogs and people and the environment touches many diseases and ailments shared by both species. This link to better understanding diseases and achieving optimal health outcomes wove throughout the 2021 AKC Canine Health Foundation National Parent Club Canine Health Conference.

This year's virtual conference, held Aug. 13 to 15, featured 18 talks presented during half-day sessions devoted to dermatology and immunology; cancer; neurology and epilepsy; and cardiology. Most of the presenters, their studies funded by CHF,

enlightened attendees with a glimpse of research that has become their life's work.

Funding this important canine health research is the mission of CHF, one that is shared with parent clubs and dog lovers. Having just passed its 25-year anniversary in 2020, CHF has provided more than \$62 million in research grants since its beginning in 1995. Purina is proud to be a charter sponsor since 1997 of CHF and of this conference. Here are highlights from this year's 13th biennial event.

A SIMILAR NEUROLOGIC DISEASE: DM & ALS

The progressive neurologic disease known as degenerative myelopathy (DM) affects more than 40 breeds of dog, including mixed breeds, says Joan R. Coates, DVM, MS, DACVIM (Neurology), professor of neurology and neurosurgery at the University of Missouri.

Shortly after Dr. Coates and a collaborative team discovered the [autosomal recessive mutation in the superoxide dismutase 1 \(SOD1\) gene](#) tied to DM in dogs, they realized it was the same gene causing some forms of familial amyotrophic lateral sclerosis (ALS), or Lou Gehrig's disease, in people. In dogs, the *SOD1* gene contains a missense mutation that codes the wrong amino acid affecting the gene's protein.

Among their similarities, DM and ALS are more likely to occur with age. Depending on the breed, dogs typically develop DM from 9 to 11 years of age; people may experience ALS symptoms from age 40 to their mid-60s. In both







20 YEARS OF CHIC

Eight parent clubs tried something new in 2001. They invested in the health of their breeds by signing up for the pilot [Canine Health Information Center \(CHIC\)](#).

Now, in its 20th year, CHIC pauses to celebrate. Adding to the excitement, the American Kennel Club recently announced it will start including a dog's CHIC number on its registration and pedigree records.

With 207 breeds enrolled and 154,474 dogs having received CHIC numbers, the program that instilled an open approach to reporting on the health of individual dogs has proved valuable.

Updating conference attendees, Eddie Dziuk, Chief Operating Officer of the Orthopedic Foundation for Animals, says, "CHIC has promoted awareness of health testing and, importantly, allows breeders to apply selective pressure to breed healthy dogs."

Co-sponsored by the OFA and the AKC Canine Health Foundation, CHIC relies on parent clubs to designate appropriate breed health tests. CHIC numbers are issued when owners submit their dogs' test results and share the information publicly in the database — regardless whether a dog passes its health clearances.

Meanwhile, the CHIC DNA Repository, which began in 2005, banks 30,877 DNA samples of dogs representing 198 breeds. Researchers worldwide have used the DNA for studies ranging from cancer and eye diseases to neurological conditions and metabolic disorders. Dziuk encourages owners to update their dogs' health records with new diagnoses to benefit ongoing research. Updates can be emailed to ofa@offa.org, along with a dog's name, CHIC number, diagnosis, and pertinent health information.

Happy Birthday, CHIC!



species, muscle weakness becomes debilitating. Hind-limb weakness renders dogs paralyzed within a year. Damage to nerve cells in the brain and spinal cord of people may cause difficulty walking, slurred speech and behavioral changes. About 5 to 10 percent of ALS is inherited, and 50 percent of children whose parents have the familial form develop ALS.

The genetics of DM is mired in complexity. "We found that only some dogs that inherit the *SOD1* mutant allele from their sire and dam develop the disease," Dr. Coates says. "Homozygosity is a risk factor for DM but not a definitive diagnosis. Further, the longer an at-risk dog lives, the higher the likelihood of the dog developing DM, giving it an age-related incomplete penetrance mode of inheritance."

More recently, some heterozygous dogs that inherit only one copy of the *SOD1* gene mutation have developed DM. This has occurred in Rhodesian Ridgebacks, Chesapeake Bay Retrievers, Bernese Mountain Dogs, German Shepherd Dogs, Australian Shepherds, Alaskan Huskies, and mixed-breed dogs. Additionally, a second *SOD1* missense mutation has been found in Berners, though it is less common.

"The heterozygous inheritance in dogs seems logical since most human *SOD1* mutations are dominant ALS," says Dr. Coates. "The fact that homozygosity is a major risk factor though not a definitive diagnosis for DM is important for breeders when they interpret DNA test results. They can breed dogs that carry the *SOD1* mutation to clear dogs to avoid producing affected dogs without reducing genetic diversity."

Importantly, because of the similarities between the two diseases, DM is now recognized as a naturally occurring model for studying ALS in people and developing new therapies. "Nucleic acid-based therapies using antisense oligonucleotides offer promise in modifying or arresting the course of neurodegenerative disease," Dr. Coates says. "We believe therapies that decrease the amount of aggregated *SOD1* in neurons are likely to reverse or slow the disorder in canine DM."

THE ENVIRONMENT AND ATOPIC DERMATITIS

Sharing insights relating human and canine atopic dermatitis (AD), Domenico Santoro, DVM, DrSc, PhD, DECVD, DACVD, DACVM, associate professor of dermatology at the University of

Florida, says, “Dogs and humans have strikingly similar AD. It is a complex, multifactorial, chronic disease that can be caused by alterations in the skin barrier, immune dysfunction, nervous system imbalance, environmental pollution, excessive nontargeted hygiene impairing immune tolerance, stress, and family history.

A pruritic, inflammatory skin disease, AD affects up to 30 percent of dogs, 10 percent of children, and 4 percent of adults. “The companionship of people and dogs, their shared environment, and the similarities between human and canine dermatitis make the dog a perfect natural animal model for this disease,” Dr. Santoro says.

Citing a Finnish study published in 2018 in [Scientific Reports](#), Dr. Santoro notes that in this study of nearly 6,000 dogs representing 258 breeds the researchers found that allergic signs were more prevalent in dogs living in urban environments, and if a dog was allergic,

it was more likely the owner was also allergic. Regular contact with farm animals and other pets was believed to protect against allergies.

Importantly, dogs are key to understanding AD and developing effective treatments. “Given the One Health effect of this disease, a canine animal model will undoubtedly be helpful as we explore novel therapies such as plant extracts, beneficial bacterial and antibiofilm agents,” Dr. Santoro says. “Dogs will help us understand the risk factors and protective factors of this complex disease.”

ENVIRONMENTAL CANCER RISK IN DOGS & PEOPLE

Lymphoma and bladder cancer are common cancers in people and dogs, says Lauren A. Trepanier, DVM, PhD, DACVIM, DACVCP, the Melita Grunow Family Professor in Companion Animal Health at the University of Wisconsin-Madison.



“OUR GOAL IS TO ESTABLISH WHETHER CERTAIN HOUSEHOLD CHEMICALS CONTRIBUTE TO LYMPHOMA AND BLADDER CANCER IN DOGS.”

Lauren A. Trepanier, DVM, PhD, DACVIM, DACVCP, of the University of Wisconsin-Madison

Increased risk for both cancers in people relates to exposure to industrial and lawn chemicals and water or air pollution, and the same may be true for dogs. Dr. Trepanier and her research team are working to measure suspect toxic chemicals and pollutants in dogs with lymphoma and bladder cancer to help identify preventable chemical exposures that may be driving these cancers.

In a [study in Boxers](#), a breed susceptible to highly aggressive T-cell lymphoma, the research group evaluated the environments of 56 Boxers with lymphoma and 84 unaffected Boxers aged 10 and older. “We found that Boxers with lymphoma are two times more likely to live within 2 miles of an active crematorium or a chemical supplier and almost six times as likely to live near an active nuclear plant,” Dr. Trepanier says.

“We also found that these Boxers with lymphoma were more likely to live in a county with a high ozone level and high human risk for exposure to volatile organic compounds (VOCs), such as butadiene from car exhaust and formaldehyde from paints and paneling. Although association does not prove causative, it raises concerns.”

As for bladder cancer in people, about half of cases are due to smoking and about 20 percent are related to workplace chemical exposures. The cause of the remaining 30 percent of bladder cancer is not well understood. Since dogs develop

9/11 RESEARCHER, DR. CYNTHIA OTTO, RECEIVES THE ASA MAYS AWARD



Dr. Cynthia M. Otto of the Penn Vet Working Dog Center

While 9/11 was life-transforming for families who lost loved ones and for America, it was life-defining for Cynthia M. Otto, PhD, DVM, DACVECC, DACVSMR.

The lead investigator of the [9/11 Medical Surveillance Study](#), her inquisitive nature steered her on a journey, notably the work continues, to learn about the short- and long-term health and behavioral effects to dogs deployed at Ground Zero, the Pentagon and the Fresh Kills Landfill at Staten Island.

Befittingly, on the 20-year anniversary of 9/11, Dr. Otto was awarded the Asa

Mays, DVM, Excellence in Canine Health Research Award from the AKC Canine Health Foundation. The award, named for Dr. Mays, a charter member of the CHF board of directors, is given biennially to a researcher who advances canine health.

Working at Ground Zero with a four-dog team as part of the Federal Emergency Management Agency Pennsylvania Urban Task Force I, Dr. Otto saw firsthand the tribulations to search-and-rescue dogs. Unlike their human counterparts, they had no protective gear yet were exposed to toxic chemicals and hazardous conditions.

With CHF funding support of \$600,000 for this research, a collection of individual studies that thus far have resulted in 11 scientific journal publications, Dr. Otto explored the impact of 9/11 related to toxicology, mortality and the dog-handler relationship. Lifetime monitoring of deployed dogs produced surprising results showing that they suffered little negative

effects compared to humans. The last surviving 9/11 dog, a Golden Retriever named “Bretagne,” died in 2016 at 16 years of age from kidney failure.

Inspired by the important role of the 9/11 search-and-rescue dogs, Dr. Otto, professor of working dog sciences and sports medicine at the University of Pennsylvania, founded the [Penn Vet Working Dog Center](#) in 2012. She currently is executive director.

Congratulations, Dr. Otto!





a similar form of aggressive bladder cancer and share environments with people, dogs may help identify chemical risk for bladder cancer in both species, says Dr. Trepanier.

A [study of 66 dogs with bladder cancer](#) and 70 older unaffected dogs compared the household proximity to high-risk chemicals and found that affected dogs were four times more likely to live in homes that used insecticides, more than four times likely to live in areas with high ozone levels, and three times more likely to have higher levels of total trihalomethanes, which are chlorination byproducts in municipal tap water.

A [second study evaluated](#) whether dogs and owners shared similar toxic exposure in the household. In 42 healthy people and their healthy pet dogs, urinary exposure to acrolein, an air pollutant in cooking fumes, arsenic metabolites linked to bladder cancer, and one herbicide breakdown product were detected in both species and were significantly higher in dogs.

“Dogs are smaller and closer to the ground, and they tend to roll in the grass and groom themselves, which could explain the higher levels in dogs,” Dr. Trepanier says. “Most importantly, we also found that higher urine chemical levels in

dogs were linked to higher chemical levels in owners, which suggests shared source of these chemicals.”

Meanwhile, research on both cancers continues. Dr. Trepanier and her team are now directly measuring VOC chemicals in dogs with lymphoma and unaffected controls. In another study, they are directly measuring acrolein and arsenic metabolites in [dogs with bladder cancer, unaffected matched dogs and their owners](#). Recruitment is ongoing for both studies. For information, contact [Dr. Trepanier](#).

“Our goal is to establish whether certain household chemicals contribute to lymphoma and bladder cancer in dogs,” Dr. Trepanier says. “Ultimately, the big picture is to provide evidence-based cancer preventive strategies.”

The ties that connect dogs and people and the environment offer hope. Dogs may help us better understand Lou Gehrig’s disease, and vice versa people may help us learn about treatments for degenerative myelopathy. There also are opportunities to gain awareness about ways to reduce atopic dermatitis and cancers such as lymphoma and bladder cancer. One Health is a bridge to a future of optimal health care for dogs and people. ■