CORNELL COLLEGE OF VETERINARY MEDICINE

DOGWatch

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Expert information on medicine, behavior, and health in collaboration with a world leader in veterinary medicine

THIS JUST IN

Cornell Research

An MRI Canine Atlas

Cornell College of Veterinary Medicine (CVM) clinical radiologist Dr. Philippa Johnson created three brain atlases (feline, canine, and equine) to help improve magnetic resonance imagery (MRI) diagnostics. "I wanted to start applying the most advanced forms of neuroimaging currently being done in human clinical research in the veterinary world. The big tool that we were missing was the brain atlas," says Dr. Johnson.

High-resolution stereotaxic brain atlases bring data obtained from multiple individuals into a standardized virtual space to be compared. "The atlas also enables us to identify a standardized region in the brain that we want to compare across subjects," she says.

Until recently, such cortical gray matter maps were missing from all existing brain atlases for dogs. To fill in the gap, Johnson and her team collated data from 40 dogs to devise their new atlas with 234 regions. "Each region is likely to have a specific function, but at this stage we don't know yet what these are," Johnson said. "We're going to understand more as we do more functional imaging of the canine brain." ■

Chalgoff Tunnacliffe | iStock photo

Cornell Chronicle story

INSIDE THIS ISSUE

Snake-Bite Death Mystery Solved

Dogs and cats have different clotting abilities

A study in the *Journal of Comparative Biochemistry and Physiology* compared the effects of snake venoms on the blood-clotting factors in dogs and cats. The researchers found that 31 percent of dogs survive a bite from an eastern brown snake without receiving antivenom, while 66 percent of cats survive. With some snakes, death is caused by "venom-induced consumptive coagulopathy," a condition in which the venom causes a massive clotting response, resulting in consumption of clotting factors and resultant inability to form blood colts.

Vectorwin | iStock photo

The researchers used a coagulation analyser to test the effects of 11 venoms on dog and cat plasma in the lab. They found the spontaneous clotting time of the blood—even without venom—was dramatically faster in dogs than in cats. This is consistent with clinical records, which show a more rapid onset of symptoms in dogs.

In addition, dogs are more likely to be bitten around the head, which is a very vascular area, so venom moves quickly throughout the body. Most dogs are also more active after a bite, often attacking the snake. Cats are more cautions, perhaps tapping a snake with a paw. With their quick reflexes, cats can avoid many bites and, if they do get bitten, it is usually out on a limb. In addition, they are more likely to hunker down and be still after a bite, so the venom does not travel as fast through their bodies.

The researchers hope their insights can lead to a better awareness of the critically short period of time to get treatment for dogs envenomed by snakes.

"As dog lovers ourselves, this study strikes close to home, but it also has global implications," says Dr. Bryan Fry, one of the researchers. "I've had two friends lose big dogs to snakebites, dying in less than 10 minutes even though the eastern brown snakes responsible were not particularly large specimens. ■

Zdenek, CN, et al. Pets in peril: The relative susceptibility of cats and dogs to procoagulant snake venoms. Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology, 2020; 108769 DOI: 10.1016/j.cbpc.2020.108769.

Canine Cancer and Environmental Toxins

Morris Animal Foundation to fund this important study

Environmental toxins are associated with many canine cancers, but we know little about exact exposure levels. University of Wisconsin-Madison researchers will look at common environmental chemicals, like those found in tobacco smoke and yard products, and individual genetic differences in response to them.

Glutathione-S-transferase (GST) enzymes in the liver are part of the frontline to protect dogs from exposures to toxic chemicals in their environment. "If we can better understand what sort of chronic household exposures are important in dogs, then we can do a better job of counteracting them and maybe decreasing the incidence of certain cancers," says Dr. Lauren Trepanier, Assistant Dean for Clinical and Translational Research at University of Wisconsin-Madison (Dr. Trepanier earned her DVM and Ph.D. at Cornell).

AL_Bilsum | iStock photo

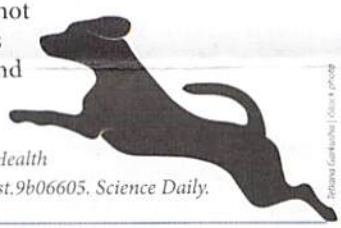
Four different forms of the enzymes will be exposed to carcinogenic substances, such as acrolein, which is found in air pollution and tobacco smoke, and 2,4-D, the herbicide associated with lymphoma and bladder cancer in dogs (see *DogWatch* April 2020, "Glyphosate and Dogs"). ■

Early Warning System for Human Health

Dogs may help with long-term effects of chemicals

Researchers from North Carolina State University and Duke University used silicone dog tags as passive environmental samplers to collect information about everyday chemical exposures. They found that dogs could be an important sentinel species for the long-term effects of environmental chemicals. "Silicone-monitoring devices are . . . an inexpensive and effective way to measure exposure to the chemicals we encounter in daily life," says research lead author Catherine Wise. "And we know that many human diseases caused by environmental exposure are similar clinically and biologically to those found in dogs."

The study recruited 30 dogs and their owners to wear silicone monitors for a five-day period in July 2018. Humans wore wristbands; the dogs wore tags on their collars. The researchers analyzed the wristbands and tags for exposures to pesticides, flame retardants, and phthalates, which are found in plastic food packaging and personal care products. They found high correlations between exposure levels for owners and their pets. However, the health effects do not follow similar timelines—a fact that could aid researchers in teasing out relationships between chemical exposure and human health. ■



Wise, CF, et al. Comparative Exposure Assessment Using Silicone Passive Samplers Indicates That Domestic Dogs Are Sentinels to Support Human Health Research. Environmental Science & Technology, 2020; DOI: 10.1021/acs.est.9b06605. Science Daily.

Preanesthetic Testing

It's a little more money, but also peace of mind

While anesthetic protocols are much safer now than even 20 or 30 years ago, it still makes sense to do some preanesthetic testing if your dog is scheduled for surgery. There are four basic areas of testing that may be recommended when your dog is scheduled for surgery:

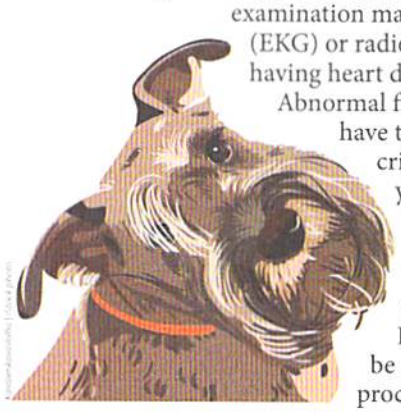
- Blood chemistries to evaluate liver and kidney functions and metabolic conditions
- A complete blood count (CBC) to look for infection or anemia
- A clotting panel to check for unknown bleeding problems
- A urinalysis that backs up the chemistry panel

Additional tests might include a heartworm test and tick-disease tests.

The information from these tests may guide your veterinarian in choosing which anesthetic drugs would be safest for your dog.

Minimal testing is recommended for young, healthy dogs scheduled for minor procedures. Examples include a quick packed cell volume (PCV), blood urea nitrogen (BUN), and blood glucose. However, dogs with a chronic health condition, older dogs, and dogs facing an extensive surgery or dentistry may benefit from a full screening ahead of time. That may involve bringing your dog in a few days before any scheduled procedure for the blood draw, with time to send samples out to a veterinary laboratory.

Senior dogs and dogs who have some unusual findings on their pre-surgery physical examination may need some extra testing. An electrocardiogram (EKG) or radiographs could be suggested for dogs suspected of having heart disease or respiratory problems.



Abnormal findings don't necessarily mean your dog will have to skip surgery, especially if that surgery is for a critical condition. The findings are a heads up to your veterinarian that some adjustments to the procedure or post-operative care may be needed. Your dog may require special intravenous fluids, different pain medications, or even to have a blood donor in the wings in case there is a problem. It's much better to know ahead of time than to be caught with an emergency in the middle of a procedure. ■

DOGWatch

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COVID-19 in German Shepherd

The dog showed respiratory signs and tested positive

As we are all aware, the COVID-19 situation changes daily, making it difficult to present the most recent information in a printed monthly newsletter. However, the growing concern about animals and the transmission of the SARS-Cov-2 virus that causes COVID-19 makes it important that you understand the connection.

As we go to press, the United States Department of Agriculture's (USDA) National Veterinary Services Laboratories (NVSL) announced the identification of the first U.S. dog with SARS-CoV-2. The German Shepherd Dog, living in New York State, was tested after one of its owners was diagnosed positive for COVID-19, and the dog began showing signs of respiratory illness. A second dog and a second person in the house had no symptoms, but both had antibodies that suggest exposure. The dog is expected to make a full recovery.

In April, it was announced that a North Carolina Pug had a positive diagnosis as part of a COVID-19 study at Duke University, but the USDA later found no evidence of an infection. "The NVSL was unable to verify infection in the Pug. No virus was isolated, and there was no evidence of an immune response based on a virus neutralization test," says Tim Atkinson of the New York State Veterinary Medical Association.

"The testing of animals for SARS-CoV-2 uses the same technology that is now employed for human testing," says Dr. Edward Dubovi, professor, Cornell Department of Population Medicine and Diagnostic Sciences. "In most instances, testing is done at animal disease diagnostic labs, and there is no competition with the human testing

Covering your dog with a face mask is not recommended. Only you need a mask.

efforts. Test samples for virus detection (polymerase chain reaction {PCR} assays) are standard nasal swabs that would be appropriate for any respiratory pathogen detection. While a specific test request for SARS-CoV-2 can be requested, a full respiratory PCR panel may be useful in achieving a diagnosis for a dog with respiratory signs," says Dr. Dubovi.

To date in the United States, one dog, two cats, three lions, and five tigers have tested positive. Felines do appear to be more susceptible, but despite the high prevalence of infections in humans, there have only been six domestic cats diagnosed with COVID-19 worldwide at this time. Ferrets are also believed to be more susceptible.

No one can predict with absolute certainty whether SARS-CoV-2 will prove transmissible from animals to humans. The Centers for Disease Control and Prevention (CDC) is not recommending routine testing of pets for COVID-19, and evidence is low that animals are spreading the virus to people. More likely, experts say, people are spreading the virus to their pets.

"If a pet is detected as positive for SARS-CoV-2, it should be isolated from other pets to eliminate the possibility of animal to animal transmission," advises Dr. Dubovi. "Pets should be handled wearing face masks and gloves would be an added safety factor. Food bowls, water dishes, and chew toys should be periodically disinfected, as the virus might be transmitted with saliva. Fecal transmission is highly unlikely as SARS-CoV-2 currently is a respiratory pathogen," he says.

For the most up-to-date information on the COVID crisis in pets go to http://tiny.cc/CW-CDC-pets (CDC information on pets). For information on animals in general, visit tinyurl.com/CW-CDC-COVID-19 and vma.org/resources-tools/animal-health-and-welfare/covid-19/sars-cov-2-animals-including-pets. ■

Tiger Came First

The first documented case of animal COVID-19 in the United States was a tiger at the Bronx Zoo. The Malayan tiger was showing signs of mild respiratory disease (as were a few other tigers and lions at the zoo) and, while ruling out other potential causes, it was decided that a SARS-CoV-2 test would be appropriate. The test, carried out at the Animal Health Diagnostic Center at Cornell and the University of Illinois and later confirmed at USDA's National Veterinary Services Laboratories, identified genetic material of the SARS-CoV-2 virus in the affected tiger. Combined with the signs observed, a presumptive diagnosis of COVID-19 was made. Subsequently, the feces of several other tigers and lions showing mild respiratory symptoms were tested using fecal polymerase chain reaction (PCRs), which showed evidence of the virus.

What You Should Do

The CDC recommends these COVID-19 precautionary measures:

- Do not let pets interact with people or animals outside the household.
- Walk dogs on a leash, maintaining the recommended 6 feet distance from people and animals.
- Avoid places where a large number of people and dogs gather.
- If you are sick with or suspected of having COVID-19, restrict contact with animals and people.
- When possible, have another member of your household care for your pets while you are sick.
- Avoid contact with your pet, including petting, snuggling, being licked, and sharing food or bedding.
- If you are sick or suspected of having COVID-19, restrict contact with animals. Ifyou must care for animals while you are sick, wear a face covering and wash your hands before and after you interact with any animals.

Dogs by a Nose

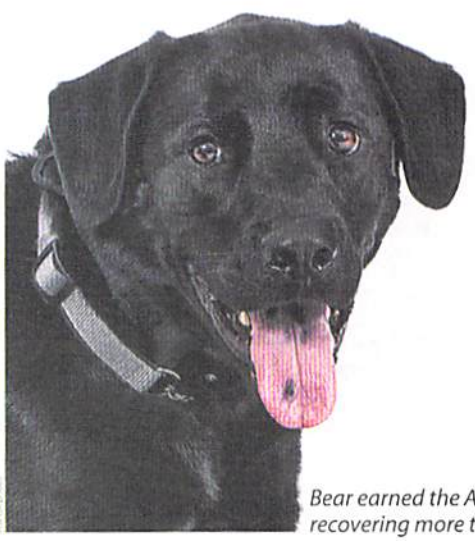
A scent dog's "testimony" can be used in court

Dogs have an incredible ability to sniff out things, which is one of the reasons they are so valuable in police work. Dogs who are trained to use their noses for law enforcement, military work, arson detection, and search and rescue are all highly trained, and their "testimony" can be used in court.

In one of the most famous cases, a black Labrador Retriever mix named Bear was instrumental in catching former Subway spokesman Jared Fogle's involvement in child pornography.

"The 2-year-old rescue pooch nosed out a thumb drive that humans had failed to find during a search of Fogle's Indiana house in July, several weeks before he agreed to plead guilty to having X-rated images of minors and paying to have sex with teenage girls," said NBCNews.com in 2015. At the time, Bear was one of only three dogs known as "porn-sniffing dogs," so nicknamed because they can detect hidden electronic storage devices, which may hold pornographic images. Bear, now a member of the Seattle Police Department, also helped find evidence against former Olympic gymnastics coach Marvin Sharp.

In 2018, Bear earned the American Society for the Prevention of Cruelty to Animals (ASPCA) Public Service Award. "Since 2015, Bear has been involved in more than 125 cases, 38 of which resulted in Bear recovering more than 100 critical pieces of evidence that would otherwise have been overlooked. Bear also provides emotional support to officers working in the stressful division, as well as to children at the sites of the raids who may need to be questioned,"says the ASPCA.



Bear earned the ASPCA's 2018 Public Service Award for his work recovering more than 100 critical pieces of evidence.

Detecting Covid-19

Even more timely, the veterinary school at the University of Pennsylvania is training dogs to sniff out the Covid-19 virus, with the help of the U.S. Army Combat Capabilities Development Command Chemical Biological Center. The only concern is that it is now known that dogs can be infected with Covid-19.

"Scent detection dogs can accurately detect low concentrations of volatile organic compounds, otherwise known as VOCs, associated with various diseases such as ovarian cancer, bacterial infections, and nasal tumors. These VOCs are present in human blood, saliva, urine or breath," said Cynthia Otto, DVM, PhD, professor of Working Dog Sciences and Sports Medicine and director of Penn Vet's Working Dog Center. "The potential impact of these dogs and their capacity to detect COVID-19 could be substantial. This study will harness the dog's extraordinary ability to support the nation's COVID-19 surveillance systems, with the goal of reducing community spread."

The need for scent-trained dogs for research is so great that the Working Dog Center at the University of Pennsylvania now offers a "Citizen Science" course where dogs and their owners are trained to distinguish scents. Dogs who successfully pass the course may get called upon to come back and work in some scent-related research projects.

Other studies have looked at dogs detecting explosives. If dogs are trained to just identify an oxidizer for the homemade explosive (such as ammonium nitrate), they will have difficulty when confronted with mixtures that might contain that oxidizer compound and other odors. Ideally, the dog also would have been exposed to mixtures of ingredients without the oxidizer. Then when the oxidizer is added, the dog zeroes in on that in the mixture. This suggests the dog needs to learn that he is identifying a specific item but not only when it is present in "pure condition."

Medical Training

Dogs have successfully been taught to alert on several cancers. These dogs pick up subtle changes in odors in feces, urine, sweat, breath, and on the skin. Cancers detected by dogs include melanomas, prostate cancer, lung, and colorectal cancer. Some dogs have shown they can identify more than one type of cancer, which suggests some neoplasias may have a common odor signal.

It's not a simple training program, though. In a small study utilizing only three trained dogs, one dog would react to the cancer cell line (versus plain culture medium) and identify other ovarian cancer cell lines as well. But, when the dog was tested with plasma from victims of ovarian cancer, the dog was unable to make the determination. More work will be necessary before a dog can reliably generalize from the cell line to a plasma sample.

Lick Sensing

Dogs have an extra sensory adaption called the vomeronasal organ (VNO), or Jacobson's organ, that most mammals use for detecting pheromones. It's a communication device and may be how a newborn finds its own mother. Many search-and-rescue dog handlers believe this ability gives dogs their edge in detecting scents.

"The dog has an additional olfactory epithelium found in the vomeronasal organ (VNO). This tissue is present bilaterally in the bottom of the nasal cavity above the roof of the mouth just behind the canine teeth. The VNO is open to the nasal cavity and connected to the mouth by small channels," says Katherine Bamford, a K9 Search and Rescue handler. "Licking brings chemicals into the mouth that are perceived by the specialized receptors, which detect pheromones important for species-specific communication, as well as other volatile molecules. Substances in water licked up by dogs can be detected through this system. The information from these sensory cells are transmitted through a separate neuronal path to the brain," she says.

Medical-alert dogs are newer on the scent-dog scene. These dogs alert a person to individual issues such as low blood glucose or the imminent arrival of a seizure. Many dogs intuitively react when a problem is approaching and warn their owners. These dogs aren't trained, but we now understand that a person's scent will change before the onset of the medical complication, and the dogs learned the connection.

Medical alert dogs are now used for epilepsy, diabetics, various cardiac conditions, and asthma. On their own, some dogs have even figured out how to detect the onset of migraines and let their owners know.

The changes the medical-alert dogs are detecting are minute chemical shifts. They can pick up high or low blood glucose and high or low cardiac rates and pressures. It is not always known exactly what a medical-alert dog is detecting, but these dogs are accurate and consistent.

Medical-alert dogs tend to work with just one person, but some dogs can extrapolate. Our Technical Editor, Debra M. Eldredge DVM, said that she was at a pet store when a woman's service dog (as designated by his vest) broke from his owner and ran to alert to a different woman in the aisle. "As the owner came to gather up her dog, I looked at the woman her dog was frantically alerting on and asked her if she was diabetic," says Dr. Eldredge. "The woman said yes, and the owner of the dog immediately had her sit down and gave her some candy. It turns out the dog was her diabetic alert dog and he had recognized the low blood sugar in this other woman."

It's interesting that seizure-alert dogs differ from seizure-response dogs. The seizure-alert dogs can tell that a seizure is about to happen and let their person know so they can get to a safe place quickly. Seizure-response dogs act after the onset of a seizure, trained to get help for or stay with the person who is having a seizure.

Nasal Influences

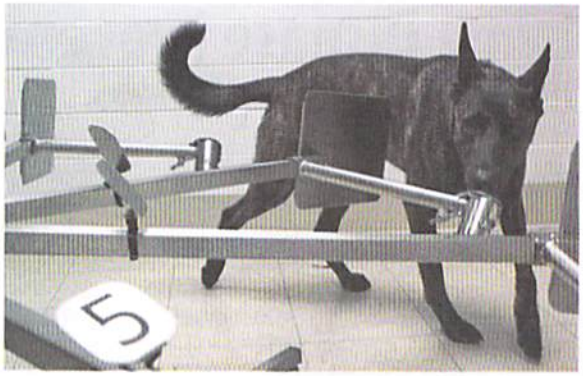
A dog's sense of smell can be influenced by certain medications but also by almost anything that affects his physical state such as exercise, temperatures, barometric pressure, humidity, and how fit he is. Research has shown that even how much food in a meal, how frequently meals are eaten, and how much fat is in a meal can all influence a dog's sense of smell. Hungry dogs are more successful at scent jobs, although it's not clear why (it could be award-associated, if they are treat-motivated).

Not surprisingly, nasal bacteria are involved with scenting. One study found that the bacteria isolated from the noses of working dogs varied with their function- vapor wake, patrol and narcotics, explosives.

Genetics and anatomy may come into play, as well as inherent work drive, but it's not a given. In one study, Pugs out-scented German Shepherd Dogs. Studies have looked at odor recognition (OR) genes and their variability among dogs. It was felt that specific polymorphisms, i.e. particular alleles at an OR locus, would enhance odor recognition accuracy.

In another study, researchers examined five OR genes, all from subsets of the olfactory subgenome that are thought to be crucial in odor discrimination, in 35 dogs. The dogs were mainly male German Shepherd Dogs with a variety of talents, including tracking and identifying specific people, narcotics detection, and identifying cancer markers. The study found that specific alleles at two gene loci appeared to be linked to odor recognition efficiency, regardless of the dog's specialty detection. This was a small sample size, but it suggests that dogs might be able to be identified early on by genetic profiles for talent in this area.

We're just scratching the surface of what dogs can do to help mankind in all areas, and we're sure more talents will be found. For now, though, we know that the most amazing thing is the seemingly limitless types of scents dogs can learn to accurately detect.



School of Veterinary Medicine, University of Pennsylvania photo

The veterinary school at the University of Pennsylvania is training dogs to sniff out the Covid-19 virus, with the help of the U.S. Army .

Why Dogs Are Super Scenters

Neurologically and anatomically, dogs are "super scenters," with 30 times the surface area of their nose devoted to their sense of smell compared to people. Dogs move air differently through their noses when sniffing versus regular respirations. The average dog takes in 30 milliliters (ml) of air per sniff. Air is inhaled directly from the front but exhaled to the side, making the dog efficient at sampling for different odors and odor patterns. They will inhale in different patterns when searching for an odor on the ground versus air scenting. Ground searches tend to have rapid, short inhalations while air scenting is more likely to have longer, deeper inhalations.

Studies suggest that dog nostrils are even specialized, with the right nostril sniffing conspecific and new odors, while the left nostril picks up familiar and non-offensive scents such as food odors. The scents from the right nostril go to the right brain hemisphere, which weeds out threatening and alarm stimuli. From the left side nostril, scent info goes to the left-brain hemisphere. If the odor a dog is following is in low concentration, only one side of his brain will be at work. With higher odor concentrations, both sides of the brain's olfactory abilities are activated.

iStock photo

Dogs start learning odors prenatally, picking up odors via what their dam ate through the aminiotic fluid. Those odor memories tend to fade by 10 weeks of age, but dogs can and do process and remember scents for long periods of time.

Lyme Disease Prevention Progress

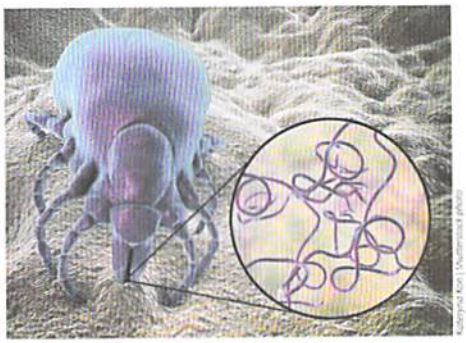
Immunology research raises hope for a reliable vaccine

One of the most difficult aspects of Lyme disease is what it does to the immune system. This disease has baffled researchers for years, but new information is coming to light that may help veterinarians with treatment and help researchers develop better vaccines.

Lyme disease is widespread throughout North America. In 2019, the CAPC (Companion Animal Parasite Council) recorded 360,000 positive tests for Lyme disease in dogs. The Council estimates this is only 30% of all cases.

In a recent webinar, Richard Marconi, PhD, Professor in the Department of Microbiology and Immunology at the Virginia Commonwealth University Medical Center, said Lyme utilizes its intermediary steps through the tick, which makes it even more effective at infecting the hosts. *Borrelia burgdorferi*, the bacteria responsible for Lyme disease, is a spirochete that acts like a corkscrew to drive itself into tissues in its victims.

Lyme is spread by the *Ixodes scapularis* tick, which is superb at infecting pets and people. The mouth of these ticks includes a hypostome, which looks like a spear with spiked edges. Once the hypostome penetrates the skin it is more difficult to remove. As if that is not enough, as the tick feeds, it secretes a cementum in its saliva to hold it in place. If you remove the tick quickly enough, your dog may not get Lyme. A tick must feed for 24 hours to transmit *Borrelia burgdorferi* to its host.



The Lyme disease bacteria, Borrelia burgdorferi, *is transmitted by the* Ixodes *tick.*

Vaccine Concerns

The goal for vaccines is to establish antibodies to the Lyme antigens. The most common Lyme antigens are Osp A and Osp C. Osp A is detectable in the tick. Once spirochetes are transmitted from the tick vectors to the hosts, the Osp A antigen is gone or greatly decreased. That means immunity to Osp A antigen is only effective for a short time, such as when the tick is first feeding on the host. The plus to antibodies to Osp A is that they could catch this infection before it gains ground in your dog. The drawback is that once the spirochete is established, antibodies to Osp A won't be much help. According to the Animal Health and Diagnostic Center at Cornell, Osp A antibodies in non-vaccinated dogs can be considered as markers of chronicity and disease severity.

The Osp C antigen is the one found on the spirochetes once they are in their mammalian hosts. This antigen stimulates two reactions: antibodies that will kill the spirochetes and long-term-memory cells that react if the antigen appears again. The memory cells tend to last longer than the antibody levels.

Osp C is not a simple antigen. Currently, many Osp C types have been identified. Seven Osp C types are common in North America. It has been determined that the antibodies to Osp C are specific for the exact type of Osp C and don't necessarily carry over to protection against other types of this antigen. Dr. Marconi points out, "There is data that suggests that certain Osp C types are linked to tissue/organ/species tropisms. No one has investigated whether a specific set of Osp C types are linked specifically to nephritis. It would be interesting to test that but we haven't been able to obtain the samples needed for that type of analysis."

Up to now, Lyme vaccines have generally had two antigens: Osp A (in the hopes of catching any spirochetes right as they enter your dog) and an Osp C to help kill any spirochetes that are in your dog. Those vaccines did not address the multiple types of Osp C.

On the Horizon

Dr. Marconi, working with Zoetis, has developed a chimeric/recombination vaccine. The chimeric part refers to a new antigenic protein with multiple types of Osp C contributed proteins. It is recombinant because only subunit proteins from the antigen are used which should make it safer and less likely to stimulate reactions. The hope is that this vaccine, now in use in some clinics, will be more effective in preventing clinical symptoms in vaccinated dogs.

Meanwhile, at Washington State University, researchers headed by Troy Bankhead PhD, associate professor in WSU's Veterinary Microbiology and Pathology department, identified a surface protein of *Borrelia burgdorferi* called VlsE. This protein acts to protect the arthritis causing surface protein from antibodies, allowing the arthritis to develop in susceptible hosts. Removal of the VlsE protein should prevent this complication of Lyme infection. So far, this has been verified in mice. Bankhead feels that it is likely that other surface proteins may be protected by the VlsE protein, opening another area for Lyme treatment and vaccine development.

Most dogs are screened for possible Lyme infection with a rapid test done at most veterinary clinics. Follow-up for positive dogs can be done via the Cornell Animal Health Diagnostic Laboratory whose Multiplex test detects total antibody levels. The pattern of antibodies to the different Osp antigens determines early or chronic infection. Your veterinarian may recommend this test to determine the complete Lyme status of your dog and to track recovery. ■

Acute vs. Chronic Lyme Disease

Most dogs who are exposed to the *Borrelia burgdorferi* bacteria have subclinical infections with mild or no symptoms. If your dog develops an acute infection, you might notice fever, swollen joints and/or shifting leg lameness, enlarged lymph nodes, a lack of appetite, and depression. Acute cases tend to respond well to antibiotic therapy.

A more chronic form of Lyme disease includes symptoms of polyarthritis, which is arthritis that affects four or more joints. You may note shifting leg lameness. This type of infection does not respond well to antibiotics. In addition, some cases will develop protein-losing nephropathy (PLN) that can lead to fatal renal failure.

Treat Yourself and Your Dog

Choose a treat your dog loves that won't blow his diet

It's fun to give your dogs treats. They get all excited and happy, and that makes us happy. But you know what they say about too much of a good thing . . . and in this case, too many treats can lead to obesity and even nutrient deficiencies. Here are some tips for choosing treats for your dog, and how to treat in moderation.

The 10% Rule

If you've been reading this newsletter or any other good source of doggy nutrition for any length of time, you have heard that treats should only make up a maximum of 10% of your dog's diet.

Why is that? Dog food is formulated to include the right balance of nutrients to keep your dog healthy and provide his body with everything he needs. You can verify this by checking the label for an American Association of Feed Officials (AAFCO) Statement declaring that the food either meets the standards of the nutrient profiles for dogs or that it has been used in feeding trials.

Treats, on the other hand, just have to be safe. So whatever portion of your dog's daily food comes from treats is very likely unbalanced and missing a variety of key nutrients. This isn't an issue if your dog is only eating a few treats a day. But if your dog turns up his nose at kibble and instead eats mostly treats, he could be missing nutrients his body needs.

Healthy Choices

"I use kibble since my dog enjoys it, and I know it's complete and balanced," says Joseph Wakshlag DVM, PhD, DACVN, DACVSMR, Section Chief of Nutrition at Cornell. Using your dog's regular food as treats is a great strategy both for ensuring that he is getting nutritional benefit from treats and to help with weight management. Set aside part of your dog's daily ration to use as treats as needed.

Veggies are a great option, too. Dr. Wakshlag says, "I also recommend vegetables like green beans, baby carrots, and squashes since these are low calorie and have some potential healthful benefits." Experiment with different veggies to see which ones your dog likes best!

As well as choosing healthier options for your dog's treats, consider the amount of treats he gets each day. Does he just get them as a reward for doing something good, like coming inside from the yard or settling down for bed? Or is he getting freebies every time a family member walks past the cookie jar? And how much is he getting at a time—just a small piece, or two large-sized biscuits? Most pet dogs tend toward the heavy end of the weight spectrum, and treats play a huge role.

Have a family meeting to discuss your dog's nutritional health and set boundaries for dispensing treats. If he is used to getting two biscuits at bedtime, cut back to one biscuit split in half (dogs are pretty good at counting, but not so good at measuring quantity). Consider whether traditional "treat times" are really necessary. It is one thing to reward your dog for holding a sit stay while you unpack the groceries, but another to give him a treat just because he looked at the cookie jar and then flashed you the puppy dog eyes.

Training Treats

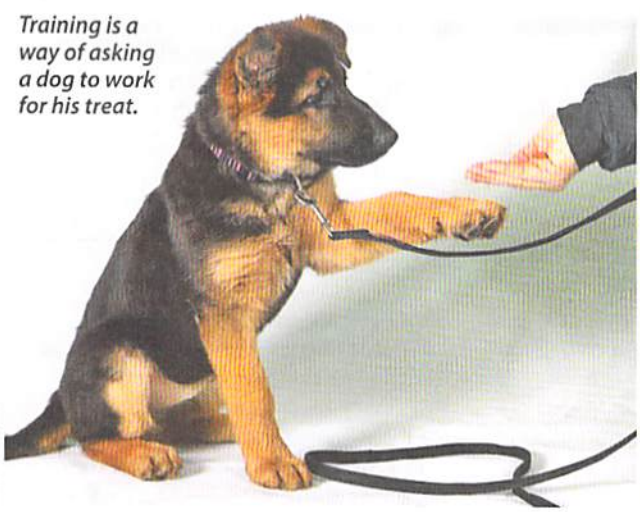
A common time to use treats is when training, whether you are working on household manners or preparing for a competition. For many dogs, using their regular kibble as training treats works great. They're easy to carry and dispense. But, kibble isn't special.

Dr. Wakshlag says you may need something higher value than kibble. "The smaller the better," he says. "We found that a lot of agility dogs were getting over 20% of their calories as treats and some dogs up to 50%. I often look for treats that have some healthful properties like added vitamins and minerals so you don't shortchange your pup."

Break treats into small pieces to stretch them farther. This has the added benefit of making a package of treats last longer, saving you money. Training sessions are better when you don't have to wait while your dog chews a large treat or (tries to eat it too quickly) every time you give him a reward. ■

What You Should Know

- Just-for-fun treats should be kibble or veggies, like carrots
- Training treats are usually yummier
- Use tiny treats—dogs notice quantity over the size of the treat
- A jackpot reward of several treats at once is reserved for great accomplishments



Training is a way of asking a dog to work for his treat.

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Bossy Barkers

Some dogs learn they get treats at certain times of day and begin to "demand" their treat, often earlier and earlier. Demanding behaviors range from intense stares to pacing near the treat stash to whining or barking.

If your dog is a bossy barker, break the cycle by never giving him a treat when he is being obnoxious. The first few times you stand your ground he may throw a tantrum. Calmly ignore him or engage him in an activity that does not involve food. When he settles down, he can have a treat.

To prevent issues from developing again, avoid having a set "treat time." Instead, keep him guessing by giving a treat at different times of day, and by asking him to work for his prize by doing tricks or basic manners like sit and down.

Anxiety Urination

Helping a difficult foster-care Goldendoodle

Q I have an anxious but very sweet loving 2-year-old Goldendoodle foster dog who pees when anxious or excited around people. Urinalysis is normal. She has had three homes before I got her, and I want to help her so she goes to a forever home.

I have worked with her, and she lets me put on a leash, pet, and comb her without peeing. She is also crate-trained and doesn't pee in it overnight.

But if I say drop something or reach out when playing, she pees—even when she brings me the toy. She gets excited when someone gets near her, wags, rubs them, and then pees if they talk to or touch her. (I ignore the pees.) I now tell visitors not to look at or touch her.

I am working on manners like having her wait and, slowly, she's getting the message. Leash walking is getting better, and "leave it" sometimes works.

I just got her an Adaptil collar and, although somewhat calmer, she still pees. I want to extinguish this behavior and find this otherwise great girl her forever home. I would appreciate your advice.

A Goldendoodle, like this puppy, is a cross of a Golden Retriever and a Poodle.

A Taking on a foster dog is a worthwhile deed. Unfortunately, you have been rewarded for that good deed by puddles on the floor! Her submissive urination may be the reason she has already been in three homes. Because submissive urination is usually a puppy problem, I imagine one of those owners punished her for urinating so the problem became worse.

You have already done some of the most important things to reduce the problem by telling visitors not to talk to her or touch her and by ignoring, rather than punishing, the behavior. The two situations when she urinates in response to you is when you reach out to her and when you say "Drop It." For the moment I would not train "Drop it." Avoid reaching toward her. Hands over the head are often a threat to a dog. You might try asking her to sit when she returns a toy because dogs are less likely to urinate from that position.

There are two other solutions. One is doggy diapers for when you think she is likely to urinate such as when company comes. Or you might use them when you are visiting another household whose rugs you would rather she did not soil. Finally, the medication phenylpropanolamine, which is an alpha adrenergic drug, might strengthen her sphincter tone. Check with your veterinarian. ■

Do You Have a Behavior Concern?

Send your behavior questions to Cornell's renowned behavior expert Katherine Houpt, VMD, Ph.D., shown here with Yuki, her West Highland White Terrier. Email to dogwatcheditor@cornell.edu or send by regular mail to DogWatch, 535 Connecticut Ave., Norwalk, CT 06854-1713.

Coming Up ...

- What's the Difference? Stay vs. Wait
- Common Injury: Luxating Patella
- Cancer! Is It OK to Refuse Treatment?
- Understanding Outbreaks of "Zoomies"

Jealousy and Aggression

Yes, dogs can be jealous

Q We have a 3-year-old female Malti-poo. I have two concerns. First, whenever I approach my wife or she approaches me, she barks and tries to get between us. She seems to be protective of both of us. Is it jealousy? Second, she loves to give and get attention, but only when she wants it. Sometimes when we just try to pet her or she is laying nearby and we go to touch her, she snips at us. She has bitten both of us. It's as if she has a moody personality. We love the dog. She waits on me coming home from work every day and is excited when I arrive. She loves to play fetch every night after dinner. I would be interested in your thoughts/advice.

A If you had asked me 20 years ago whether your little dog was jealous, I would have accused you of anthropomorphism, but now we know that dogs do exhibit jealousy. If you pet another dog, even a stuffed dog, your dog will be aggressive.

You might want to read *How Dogs Love Us* by Gregory Berns. He is the physician who, using dogs trained to lie still in an MRI, found the part of the brain activated when the dogs saw their owner feed another (fake) dog. It's the same part of the brain that is activated when humans feel jealous. It might help to work on her sit and stay so you can distract her.

Her bigger problem is her aggression. Many dogs do not like to be petted, so it is a good idea to teach her to sit before you pet her. That way she is forewarned and you will be able to tell by her expression—stiff posture and hard stare means bad mood—whether she is in a good mood or not. Your address shows you are only a few hours from Cornell, so you might want to bring her in for a full behavior consult. Call 607-253-3060 to start the process. ■

HAPPENING NOW...

Giant Toxic Toads—Yellowish brown cane toads in South Florida are thriving, which is a big worry for pet owners, says the *Miami Herald*. The toads have glands behind the eyes that contain a milky-white toxin that can kill dogs. The toads have no predators.

That's Dr. Moose—An 8-year-old Labrador Retriever named Moose was awarded an honorary doctorate in veterinary medicine by Virginia Tech for his work assisting in more than 7,500 counseling sessions, in addition to his regular therapy work, says CNN. ■