bark&whiskers™

Dog Tips

How the Brains of Anxious Dogs Differ From Others

When your dog reacts to sudden loud noises, such as fireworks and thunderstorms, or changes in his routine that leave him acting fearful and anxious, could it all be in his head? This surprising new research reveals how the brains of dogs with anxiety may be wired differently.

Analysis by Dr. Karen Shaw Becker

STORY AT-A-GLANCE

- New research using functional MRI technology reveals that the brains of dogs with anxiety are wired differently than those of non-anxious dogs; specifically, they show stronger connections between the amygdala and other regions of the "anxiety network"
- The study analyzed dogs with diagnosed anxiety and non-anxious dogs in a resting state, and found that the brains of dogs who showed fear and anxiety towards strangers, as well as excitability, were more likely to show abnormal network metrics in the amygdala
- Anxious dogs suffer from a level of stress that left unchecked can negatively affect their health and lifespan
- There are several common canine stress triggers, including sudden loud noises, punishment-based training methods and lack of opportunities to express normal species- and breed-specific behaviors
- One way to ease your dog's anxiety is to make sure he's getting lots of exercise — both mental and physical — daily

A newly published study by researchers at the University of Ghent in Belgium suggests that dogs with anxiety have "different brains." Specifically, they appear to have abnormalities in functional neural networks.

Brains of Anxious Dogs Have Different Wiring

Research into anxiety in animals is considered an important tool for studying anxiety disorders, producing results that can benefit both veterinary and human medicine. While rodents are typical study subjects, there are too many different aspects of anxiety to study in just one species of animal. Compared to rodents, dogs have larger brains and bigger cortexes, which is advantageous in characterizing neural networks associated with anxiety.

The University of Ghent study results, published on March 17, 2023, in the journal PLoS One,[1] show that compared with healthy (non-anxious) dogs, dogs with anxiety demonstrate stronger connections between the **amygdala** (a major processing center for emotions that also links emotions to many other brain abilities, especially memories, learning, and the senses) and other regions of the anxiety network.

The study involved 25 healthy dogs belonging to the university, and 13 anxious family dogs who were volunteered by their owners. The dogs were examined by non-invasive functional MRI (fMRI) technology. The researchers analyzed the resting state of both groups of dogs, comparing neural network metrics and connectivity between the groups, and determining their associations with anxiety symptoms.

They observed that while at rest, the anxious dogs had stronger connections between the amygdala and other parts of the anxiety circuit, especially the hippocampus (a region of the brain associated primarily with memory). The brains of dogs who showed fear and anxiety towards strangers, as well as excitability, were more likely to show abnormal network metrics in the amygdala.

Dysfunction in Certain Brain Regions May Lead to Anxiety

Previous research has established an association between the amygdala and hippocampus with dogs' memories and emotional states such as arousal, excitement, and fear.

> *"Dysfunctions of these regions can lead to anxiety symptoms like more fear, less excitability, less trainability, and so on, which are in line with previous human research," the study authors noted. "A particular highlight of our results is the connection between the hippocampus and mesencephalon [midbrain].*

> *Here, a less efficient communication was found between the hippocampus and mesencephalon in the anxiety group."*[2]

The midbrain is responsible for vision, sleep, alertness, hearing, and motor control.[3]

> *"It has been reported that dysfunction of the hippocampus and the mesencephalon is related with high risk for psychosis in humans," the study authors added.*

The study authors believe their findings demonstrate that resting-state fMRI is a good tool for studying dog models of anxiety. Future studies could increase our understanding of how anxiety-related circuitry in the brain is altered in animals, and possibly even humans, with anxiety disorders.

It should be noted that the study was limited by the small sample of anxious dogs, most of whom were adopted from animal shelters with life experiences that may have included abuse and/or neglect. Mistreatment can influence the brain's anxiety networks. In addition, dogs born and raised in a lab like the 25 non-anxious study dogs, differ from dogs raised in family homes.[4]

8 Common Canine Stress Triggers

Many dogs today are prone to anxiety, and research suggests that the stress of living with a fear or anxiety disorder can negatively affect dogs' health and even how long they live.[5]

When a dog feels anxious, his body releases an excessive amount of norepinephrine, the fight or flight hormone, which can alter gut bacteria and interfere with gastrointestinal (GI) tract motility.[6] This flood of norepinephrine can result in physical symptoms like diarrhea, and when a housetrained dog has an accident indoors, it only intensifies his stress.

Some dogs experience short episodes of stress, while others suffer chronic stress. Even if your dog's brain is wired differently than the brains of his more relaxed counterparts, the more you know about what triggers his anxiety, the behaviors he tends to perform when he's anxious, and the effect of stress on his health, the better able you'll be to identify the signs and take action to minimize or eliminate stressors.

It’s also important to recognize that while from your very human viewpoint, the environment you provide for your dog is stress-free, dog stressors can be quite different from human stressors.

Some of the causes of stress in dogs are species-specific, while others are triggers that can cause anxiety in humans as well. And just like sensitive people, sensitive dogs tend to be more susceptible to stress. Some common triggers include:

1. Sudden loud noises (e.g., fireworks, thunderstorms)
2. Punishment-based training methods involving yelling, hitting, shock collars, etc.
3. Adverse relationships with other pets or humans in the household
4. Unwanted attention such as being randomly awakened from a nap, or being forcibly hugged, kissed, or held
5. Lack of opportunities to express normal species- and breed-specific behaviors such as sniffaris, running, retrieving, hunting, herding, etc.
6. Exposure to the strange and unfamiliar (objects, animals, people, etc.)
7. Changes in housing, household routine, or household members
8. Separation from family members, including other pets

As you attempt to identify the triggers for your dog’s anxiety, also consider her history. If you adopted her as an adult, what do you know about her past? Was she abused or neglected? Is she anxious mainly around men or kids? Other dogs?

How to Minimize Your Dog’s Anxiety

Some of the things that cause anxiety in dogs can be unavoidable, such as thunderstorms or a move to a new home. However, there are several things you can control to minimize stress and improve your dog’s quality of life. Examples:

- Use only relationship-centered, fear-free behavior training/trainers, and intervene as soon as possible.
- Help everyone in the family understand and respect your dog's need for uninterrupted sleep and human handling he feels comfortable with.
- Increase your dog’s daily physical activity level, since the vast majority of dogs, especially large breeds, don’t get nearly enough. Daily movement is extremely important in mitigating your dog’s stress response.
- Dogs left alone for several hours during the day get lonely and bored. If there's often no one home to keep your dog company, recruit a friend or neighbor or hire a dog walker to take him for a stroll around the block, at a minimum. An alternative is doggy daycare.
- Engage in brain games, sniff-centered walks, or nose work on a daily basis. Most dogs are mentally under-stimulated. Giving dogs fun jobs, tasks and mental exercises that engage their senses promotes healthier brain chemistry and more balanced behavior.

While you work to get to the root of the anxiety and positively repattern behaviors, there are many natural options to help calm your dog’s nerves. Playing music, especially classical music, is one simple strategy.[7]

However, one of the most important steps is to make sure your dog is getting lots of exercise — both mental and physical — daily. I have found a dog’s anxiety is inversely proportional to the amount of exercise they get.

If anxiety occurs when your dog will be home alone, leave him with an article of clothing or blanket that has your scent on it. Schedule dog walkers and check out doggy daycares. Look at remote treat-release toys or a lick mat to help him pass the time. I also recommend consulting an integrative veterinarian about stress-lowering herbal and nutraceutical protocols.

If your dog's anxiety appears to be getting worse instead of better, enlist the help of a force-free behaviorist or trainer, veterinary behaviorist and consider looking into applied zoopharmacognosy.

Sources and References

ScienceDaily, March 15, 2023

[1, 2] Xu, Y. et al. Network analysis reveals abnormal functional brain circuitry in anxious dogs. PLOS ONE, 2023; 18 (3): e0282087

[3, 4] Forbes, March 15, 2023

[5] Dreschel, N.A. Applied Animal Behaviour Science. July 2010, Volume 125, Issues 3-4, Pages 157-162

[6] Journal of Physiology and Pharmacology. 2011 Dec;62(6):591-9

[7] Animal Welfare, Volume 11, Number 4, November 2002, pp. 385-393(9)