

COTON HEALTH REPORT

How Taurine Protects the Canine (and Human) Heart

by Robert Jay Russell, Ph.D., CTCA President

People and small dogs are prone to a debilitating, often fatal heart condition called congestive heart failure, "CHF." This is a progressive enlargement of the heart as it struggles to propel blood throughout the body. The muscle thickens (primarily in the left ventricle), the heart enlarges and becomes less efficient in time.

In small dogs, CHF is the progressive result of the destruction of the heart valves. The valves lose their ability to close securely, essential to prevent back flow ("regurgitate") as the heart muscle contracts to push its fluids away from the heart.

The failure of the valves to close adequately can often be heard as a distinctive "click" and the regurgitation a swirl of fluid — a characteristic murmur that an experienced veterinarian can pinpoint using his/her stethoscope. Some veterinarians believe they can actually detect a growing bacterial vegetation coating a diseased valve by the sound the valve makes (see below).

Most commonly, the mitral valve of the heart is the valve that is damaged and that leads to progressive congestive heart failure. The destruction of the mitral valve has a clinical name, Mitral Valve Disease [MVD]. It impacts both dogs and humans. Each year many thousands of dogs succumb to this disease; more

than 120,000 American humans suffer from it.

What Actually Damages the Heart Valves?

Bacteria are the most common culprits causing MVD. They favor the heart valves where they coat the valve like a colony of slime. In fact we have a name for this newly discovered, cooperative "super-organism." Colonies of social bacteria are called "biofilms." They act as a single unit, and render the mitral valve floppy and ineffective, allowing blood which should be moving in one direction — out from the heart and throughout the body — to flow back into the heart.

The heart attempts to compensate for its leaky mitral valve by pumping harder. The heart adds cardiac muscle until the walls of its ventricle thicken too much. In just a few years, the enlarged heart is less efficient at pumping than it has ever been. Congestive heart failure is then full blown.

The floppy mitral valve with its cargo of bacteria eventually fails altogether (mitral valve prolapse — "MVP"). Before it reaches that

terminal state, humans have their diseased valves replaced by artificial valves, sometimes made from Gore-Tex. Dogs are not so lucky. There are no surgical valve replacements currently available for ailing small dogs.

The growing colony of bacterial biofilm originates from many possible sources including rheumatic heart disease and, critical for our dogs, dental disease.

Now that we have a basic understanding of what is the primary cause of heart disease that endangers our Coton's lives (valvular disease that leads to congestive heart failure), what can we do about it? Before we describe preventative care, we need to know what *specifically*

An Interesting Anecdote:

Many years ago, my father, J. Lewis Russell (Oakshade Kennel), placed some of his Coton on a daily dose of Amoxicillin, a well-tolerated penicillin family antibiotic. He was extremely concerned with keeping his Coton's oral health free of disease, and his veterinarian at the time agreed. Interestingly, the prophylactic use of this antibiotic may have kept valvular disease at bay.

Of course willy-nilly use of antibiotics is now known to be a serious mistake as it can result in antibiotic resistant bacteria. But targeted use of antibiotics to help eliminate an ongoing bacterial disease is certainly warranted.

causes the structure of the heart valve itself to fail. If we knew that, we might be able to not only help prevent valvular damage, we might actually be able to reverse it!

In that regard, an article that appeared this summer has provided a key piece of evidence. Researchers at Colorado State University have found that a neurotransmitter normally associated with the gut and brain — serotonin — is also produced by diseased heart valves. And the serotonin produced there destroys the valve. This is such an important finding that I have presented the Colorado State University press release detailing this research in a box on the next page.

In my opinion, this discovery could be one of the greatest discoveries in cardiac research this century. Furthermore, the discovery that damaged heart valves produce serotonin helps explain why the amino acid Taurine — that I have long advocated as a daily supplement for all dogs — works.

How Does Taurine Work to Protect the Heart?

Taurine is an unusual amino acid. More familiar amino acids are the building blocks proteins, and proteins form the basic structures of our bodies: the muscles, the blood cells, enzymes.

Taurine operates alone. It is produced in humans and dogs in the pancreas, and is secreted into the intestine along with bile. Taurine's activity within the body is diffuse and widespread. Taurine

is found in the gut, in the brain (especially in the hippocampus, one of the most important pathways in arousal and memory) and around the heart within the heart's membranous protective sack called the "pericardium" [lit: "around the heart"].

Taurine is known to help mediate many physiological functions. It has been shown to aid in weight loss, nerve transmission, and it helps inhibit stress and aggression.

In the brain, taurine is an inhibitory neurotransmitter. That is, it acts to reduce or stop anxiety and even convulsions. Many Down's Syndrome children show an increased IQ when supplemented with taurine. Taurine acts (along with other neurotransmitters) to inhibit and modulate the release of serotonin ([Glutamate, GABA, glycine and taurine modulate serotonin synthesis and release in Neurochem Int 23: 269-83. \(1993\).](#) This, I believe, may be key to understanding how it protects the heart valves from their release of heart valve destructive serotonin.

An Essential Amino Acid?

For domestic cats and human infants and children, taurine is now considered an essential amino acid. It is considered a "conditionally essential" amino acid in adult humans. I believe it should be considered an essential amino acid for all humans.

An "essential amino acid" is one that should be acquired in the diet of the animal. That is, it is an amino acid which is either not synthesized (manufactured) or not adequately synthesized by the

animal.

While adult humans and dogs synthesize taurine from cysteine and methionine, provided B6 and zinc are present, it is likely they do not synthesize enough. Moreover no studies have shown whether or not taurine synthesis declines with age or in disease. It probably does.

In fact, the pet food industry has begun to realize the need to add taurine to a dog's diet. Some high end dog foods now list taurine as an ingredient (check the package label). However, it is unlikely that sufficient amounts of taurine are present in any manufactured commercial dog food, hence I strongly advise adding a taurine supplement to the diet of your dog. Too much taurine is not toxic.

How much Taurine should you supplement?

Taurine is easy to acquire through a human vitamin store. Both Vitamin World and GNC Nutrition Stores, commonly found in shopping malls, stock taurine pills. They come in two sizes: 500 mg and 1,000 mg. Taurine is cheap: \$4-\$6 for 50 pills.

I have recommended previously that all dogs, puppies thorough seniors, should get 250 milligrams of taurine daily. It should be added to wet food, although it can be given using a Greenies Pill Pocket or a dollop of Velveeta cheese or Braunschweiger.

It is best to buy the 500 mg pill size, then break the oblong pill in two. I crush the pill into a

Colorado State University Press Release: Cardiac Research Shows Diseased Heart Valves In Dogs Produce Serotonin

Article Date: 22 Jul 2009 - 1:00 PDT << <http://www.medicalnewstoday.com/articles/158296.php> >>

A significant part of the question of what causes mitral valve disease in dogs, giving scientists and medical experts clues into new possible ways to treat or prevent the disease, may have been solved by a Colorado State University veterinarian. The discovery refutes the current belief that mitral valve disease, the top heart disease in dogs, is inevitable as a part of aging in pets.

Dr. Chris Orton, a cardiac surgeon at Colorado State's Veterinary Teaching Hospital, has been investigating the role of serotonin in heart valve disease in dogs. It has been known for some time that drugs that enhance serotonin production in humans — such as appetite suppressants, migraine medications and antidepressants — cause drug-induced heart valve disease. It turns out that naturally occurring heart valve disease, known as degenerative myxomatous heart valve disease, is virtually identical in dogs and humans. Dr. Orton's group has discovered that cells in diseased heart valves of both dogs and humans produce serotonin locally, and this may be driving the disease process.

"Serotonin is made in the brain and in cells in the gut. We previously thought that those were the only places it was made before it is circulated in the blood," Orton said. "But we found the local creation of serotonin in diseased heart valves. We think that drug-induced and naturally occurring heart valve disease share the same mechanism for creating the disease - the production of serotonin. The valve is making serotonin, which causes its own disease. Serotonin is directly linked to pathologic changes in the valve, which cause the malfunction of the mitral valve."

Orton's group is working to discover what triggers the enzyme in the valve that makes serotonin, and he would like to launch a clinical trial on dogs to look at the impact of a drug that inhibits the enzyme that produces serotonin in the heart.

Mitral valve disease impacts the mitral valve, one of two valves on the left side of the heart. In degenerative valve disease, the valve becomes deformed and begins to leak. Serotonin is made in the gut by an enzyme called TPH1. Serotonin then goes into the blood stream where it is picked up by platelets which are involved in blood clotting. Orton's group has shown that TPH1 is present in high levels in abnormal mitral valves from both dogs and humans.

"Like all diseases, mitral valve disease is mediated by cells," Orton said. "If we can understand the mechanism in cells that triggers the disease, we can slow, treat or prevent the disease process in new ways."

Mitral valve disease, also often called mitral valve prolapse in humans, tends to impact smaller breed dogs and usually develops when they are middle aged or older. Chihuahua, King Charles spaniels, and other toy and small breeds of dog tend to develop the disease more often than other breeds. Of the dogs that develop heart disease, 40 percent develop mitral valve disease, and the disease is the eventual cause of about 70 percent of all heart failure in dogs.

Orton heads up Project CARE at Colorado State. The project focuses on researching the causes of and development of new treatments for mitral valve disease in dogs. The project is supported through grass roots funding. To learn more about the program or to support the research, visit <http://csuvets.colostate.edu/heartcenter/research/mvd/index.shtml>

The Colorado State research papers:

Disatian S, Ehrhart EJ, Zimmerman S, Orton EC. Interstitial cells from dogs with naturally-occurring myxomatous mitral valve disease undergo phenotype transformation. *J Heart Valve Dis* 17:402-412,2008.

Disatian S, Orton EC. Autocrine serotonin and transforming growth factor b 1 signaling mediates spontaneous myxomatous mitral valve disease. *J Heart Valve Dis* 18:44-51, 2009.

powder using an inexpensive mortar and pestle. These can often be purchased at Chinese dollar stores or at gourmet kitchenware stores. The powder can be easily sprinkled on to the dog's dinner.

While the 250 mg daily dose of taurine seemed reasonable at the time I suggested it, evidence is mounting that even more taurine daily may be advisable. The latest edition of one of the most highly respected veterinary formularies, Donald C. Plumb's *Plumb's Veterinary Drug Handbook, Sixth Edition* (Blackwell Publishing, Ames, Iowa, 2008) added a section

on taurine and says this about dosage:

“For taurine-deficiency related cardiomyopathy: In American Cocker Spaniels: give 500 mg taurine PO q12h with 1 gram of carnitine PO q12h.”

Translated from the vet speak, that means for a dog with a slightly enlarged heart — or one with a heart murmur — “give 500 mg orally twice each day along with 1 gram of carnitine orally twice a day.”

Therefore, it is *reasonable* to give a nonsymptomatic, healthy

Coton de Tulear 250 mg of taurine once or even twice a day. For a symptomatic Coton de Tulear (coughing at rising in the morning; an enlarged heart, etc.), or one with a heart murmur of Grade II, administer the full recommended dose of 500 mg twice each day and add the carnitine as well.

What's the Carnitine For?

We'll explore the role of carnitine in helping heal the heart in the next issue of the *Coton de Tulear News*. — 🐾

