

# Today's Breeder

ISSUE 37/\$2.95

A PURINA PUBLICATION DEDICATED TO THE NEEDS OF TODAY'S BREEDER

## Treating Canine Liver Disease

- Proper Nutrition And Medication
- Eliminating Copper Toxicosis
- *Purina Veterinary Diets*  
**EN GastroENteric Formula**
- **BREEDER PROFILES**  
Carillon Bedlingtons  
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**Treating Canine Liver Disease..... 4**  
When diagnosed early, dogs with liver disease may recover completely, provided no permanent liver damage occurs. Proper diet and medication are important.

*PURINA VETERINARY DIETS*

**EN GastroENteric Formula:**

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Easily digestible fat plus increased zinc and antioxidants help to make *Purina Veterinary Diets™ EN GastroENteric™* brand canine formula an ideal diet for dogs with liver disease.



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Lucy Heyman of Carillon Bedingtons has produced many champion Bedlington terriers, such as retired CH Capstone One Under Par ("Birdie").

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CH Capstone Clearly Carillon ("Caddie"), owned by Lucy Heyman.

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# The Lamb That Barked

Bill Heyman never forgot “the lamb that barked.” Childhood memories of seeing a distinctive lamblike dog inspired him many years later, in 1977, to present a Bedlington terrier to his wife, Lucy Heyman, as a wedding gift.

Not long afterward, the Heyman family, including 8-year-old daughter, Nicole Heyman, packed up their car with a card table, some chairs and a dog comb to take part in a all-breed dog show in McAllen, Texas, with their pet Bedlington, “Gucci.”

“We were all bitten by the competition bug,” Lucy says, remembering the day in 1978 that ultimately influenced her life and many Bedlington terriers.

Eventually, Gucci became CH Glen Valley I Am Music, and Nicole became an accomplished junior handler. “We learned important life experiences showing dogs,” Lucy says. “The whole family enjoyed it.”

While Lucy had grown up with a black standard poodle named “Pogo,” she never dreamt about becoming a dog breeder. She was more familiar with selling spots for commercial advertising in the mid-size Brownsville, Texas, NBC-TV market, where she worked in sales and Bill was general manager.

*Lucy Heyman, owner of Carillon Bedlingtons, with Carillon Chocolat (“Juliette”), left, and Carillon Serendipity Love Song (“Luv”), 4-month-olds bred from different litters. Luv, who was sold to a Japanese breeder will compete in conformation in Japan, and Juliette will be shown in the United States.*



Today, the owner of Carillon Bedlingtons in Spring, Texas, north of Houston, Lucy has bred and raised more than 55 American Kennel Club (AKC) conformation champions. Among the kennel’s top champions is AM/CAN CH Carillon Boulevardier (“Mo”), who was the No. 1 Bedlington terrier breed winner in the United States in 1997 and No. 1 in all systems in Canada in 1991. At age 12, Mo is the breed’s top living sire, having bred 28 champions, with several more pointed.

Another outstanding Carillon Bedlington, CH Carillon Salsa Serendipity (“Susie”), CGC, holds the record as the top-producing dam of all time, with 16 champion offspring. Susie, who is featured on the cover of “The Official Book of the Bedlington Terrier,” represents the Serendipity bloodline that Lucy co-breeds and co-owns with Cynthia Cook, D.V.M., Ph.D., a Bedlington breeder in San Mateo, Calif.

Carillon Bedlingtons currently is home to 12 adult dogs and seven puppies. Other kennel terriers include a Lakeland terrier, daughter of CH Black Watch Griz, a line Lucy co-owns with Capt. Jean Heath and actor Bill Cosby; a wire fox terrier, bred from a Welsh bloodline; and a smooth fox terrier, a gift to Bill from the mother of professional handler Tracey Gustavson of Winona, Texas.

Twelve spacious 3-by-8 foot outdoor kennels provide fresh air and room for exercise. The connected kennels are situated on concrete under a covered porch attached to the Heymans’ house. During hot Texas summer afternoons and at night, Lucy brings the dogs inside the house to large crates in an air-conditioned kennel room. Adjacent to the breeding kennel, which is enclosed by a 6-foot-tall wooden fence, is the Elkin Pet Care Center, a commercial boarding and grooming facility that Lucy owns. Here, professional handler and groomer Artt Chapa teaches grooming at the Carillon School of Grooming.

Being a breeder forces you to learn many facets about caring for dogs, such as proper nutrition, Lucy says. She feeds her adult Bedlington terriers *Purina Pro Plan* brand Lamb & Rice Formula and her puppies *Purina Pro Plan* Puppy Formula. “Dogs are only as good as what you put in them,” she says. “You want your dogs to be trim but to feel solid and well-nourished. You have to be sure you are feeding the right food at the right time in the right amount to ensure





Professional handler Artt Chapa, above, with CH Capstone Clearly Carillon (“Caddie”), who recently earned his championship title by winning a Group One from the classes at the Bay Town Kennel Club dog show in Houston.

These 5-week-old Bedlington terrier puppies, right, are the first litter sired by CH Capstone Clearly Carillon (“Caddie”). Though Bedlington terrier puppies are born solid brown or black, their noses indicate whether they will develop liver, sandy or blue coats. “I don’t worry about sex and color,” Lucy Heyman says. “I worry about producing healthy, quality puppies.”



proper development. You don’t want puppies to be too fat.”

An English breed first bred in the 1700s, the Bedlington terrier was developed by working people who crossed English otterhounds, Dandie Dinmont and black & tan terriers to produce a hunting dog that would drive out pesky rodents and badgers. Imported

◆  
**“Breeders have a tall order. You can’t get rid of hereditary problems, but you can manage and control them.”**

Lucy Heyman

◆

to the United States in the late 1800s, the Bedlington terrier was one of the first breeds to have a national specialty.

The Bedlington takes its lamblike look from its soft coat, topknot, drop ears and gently arched back. Though the breed’s appearance has changed little through the years, its grooming pattern has become increasingly fancy. A Bedlington terrier requires from three-



to-six weeks to ready its coat for a conformation show.

"You want the hair to bloom," Lucy says. "The process involves repetitive bathing, hand-scissoring and refining the coat to maintain the pattern. In addition, the neck, throat, tail and ears, except for the ends, which have silky tassels, are shaved to accentuate a dog's strong points."

Approximately 60 Bedlington terriers, or about 30 percent of the 185 dogs registered annually with the AKC, achieve conformation titles each year. "The fact that so many Bedlingtons compete in conformation demonstrates that breeders are exhibiting their dogs to improve the breed," says Lucy.

Improving the breed was precisely Lucy's goal when she bred her first litter in 1981. Her bitch, CH Claremont Lana, came from a well-established line known for its longevity, quality physical characteristics, proper temperament and good health. Lana was sired from the last litter produced by CH Jolee Jingle Bells of Dovern before he died at the age of 14. Jingle Bells, who is the second-top producing Bedlington sire, produced 36 champion offspring and more than 100 champion descendants in Lucy's bloodline alone.

Carillon Bedlingtons was developed from two bloodlines. For the first 10 years, Lucy focused on breeding the Jingle Bells bloodline, paying homage to the kennel's foundation sire when she adopted Carillon Bedlingtons as her breeder name. She later added the AM/MEX/INTL CH Magic Mist Sir Blue, CDX, bloodline. Sir Blue came from the Foggyfurze line that was famous in England from the 1940s through the '80s. "When I added that to the mix, things really started happening," she says. "We started getting outstanding results."

In the 1980s, when Lucy began breeding, she quickly learned there was no defined bloodline for Bedlingtons. Breeders mostly were outcrossing, or using distant linebreedings, to avoid passing on recessive traits for diseases, such as copper toxicosis (see "Eliminating Copper Toxicosis" on page 18), a potentially fatal disorder that causes an excessive accumulation of copper in the liver.

"Breeders have a tall order," Lucy says. "You can't get rid of hereditary

problems, but you can manage and control them." Carillon Bedlingtons contributed to development of a DNA marker test for copper toxicosis by submitting blood samples and pedigree information to geneticists at the University of Michigan. As a result, in 1995, CH Carillon Fuzzy Logic was the first Bedlington terrier to be identified as a noncarrier of copper toxicosis.

Through the years in developing the Carillon bloodline, Lucy also has worked with copper toxicosis experts David Twedt, D.V.M., of Colorado State University's College of Veterinary Medicine and Biomedical Sciences, and Larry Thornburg, D.V.M., Ph.D. of the University of Missouri College of Veterinary Medicine.

Before the DNA marker test was available, Lucy endured her share of losses due to the disease. "Breeding teaches you about life," she says. "It takes a lot of steel. You have to be able to deal with tragedies and triumphs."

Though daughter Nicole stopped showing dogs as she got older, she became an advocate for homeless dogs and cats. Now working as a defense lawyer in New Orleans, her household stays busy with two-rescued mixed-breed dogs and three cats.

As a breeder, Lucy says, "My experiences have not only enhanced my life but also have forced me to refine my skills. If you are doing things right, you are always learning and growing." ♦



Lucy grooms Caddie by hand-scissoring to produce a full coat. Preparing a Bedlington terrier for a conformation show takes from three to six weeks. Among the important traits Lucy has developed in her bloodline is proper neck and shoulder placement. "If the front isn't right, you've got a major problem, since this determines whether the dog will move properly," she says.



# Eliminating Copper Toxicosis

Copper toxicosis, a potentially fatal disease involving a toxic accumulation of copper in the liver, was first identified in Bedlington terriers in 1975.

A lesser-known breed, only 185 Bedlington terriers were registered last year with the American Kennel Club (AKC).

The inherited disorder, believed at one time to affect 80 percent of Bedlington terriers, likely evolved from a genetic defect when the breed was being developed in the 1700s in England, says David C. Twedt, D.V.M., professor of small animal medicine at Colorado State University's College of Veterinary Medicine and Biomedical Sciences.

Copper concentrations in affected Bedlington terriers may exceed more than 15 times the amount found in normal dogs. "Bedlingtons seem to have developed a protective mechanism to survive along with the genetic inability to get rid of copper," Twedt says. "Due to disease prevalence, all Bedlington terriers should be screened to eliminate the trait from the breeding population."

Twenty breeds are recognized as having abnormal copper concentrations in conjunction with liver disease (see "Breeds Associated with Increased Liver Copper Concentrations" on page 5).<sup>1</sup> Besides Bedlington terriers, other breeds with a genetic link include West Highland white terriers, Skye terriers, Doberman pinschers and Dalmatians. For other breeds, the copper accumulation may be secondary to chronic liver disease, which alters the ability of the liver to excrete copper.

Treatment is key to survival. "Without treatment, affected dogs develop liver disease and die, usually between 3 and



*CH Capstone Clearly Carillon ("Caddie") of Carillon Bedlingtons (see "The Lamb that Barked" on page 14). Carillon Bedlingtons produced in 1995 the first Bedlington terrier to be identified as a noncarrier of copper toxicosis by molecular genetics.*

7 years of age," says Vilma Yuzbasiyan-Gurkan, Ph.D., associate professor of microbiology and molecular genetics and of small animal clinical sciences at Michigan State University, who led the effort to develop a DNA linkage test in 1995 for copper toxicosis in Bedlington terriers. "Our DNA test enables breeders to distinguish normal, affected and carrier dogs when pedigree information also is provided. Most important, affected dogs can be treated early in the disease process, and disease carriers and affected dogs

can be taken out of the breeding pool. In order to prevent a genetic bottleneck, carriers can continue to be used in breeding programs for another generation or two, in matings with homozygous normal dogs, without producing affected dogs."

## Function of Copper

Copper, the third most abundant trace element in the body behind iron and zinc, plays a crucial role in the body's metabolic processes.<sup>1</sup> However, too much copper can be toxic. In Bedlington terriers, damage to the liver can occur when copper reaches 2,000 parts per million; however, copper concentration can go as high as 10,000 parts per million.<sup>2</sup> Normal canine liver concentration should be less than 400 parts per million.

Excess unbound copper can interfere with the structure or function of liver cells, affect the integrity of plasma membranes, and damage lysosomal, or enzymatic, membranes.<sup>2</sup> "The liver is central to maintenance of copper in the body," Twedt says. "It processes absorbed metal and regulates the amount retained. Copper in the liver binds to a protein called metallothionein and eventually is excreted into bile."

## Clinical Signs

Clinical signs of copper accumulation often develop late in the disease process. "Dogs have varying degrees of depression



and are partially or completely off feed, meaning they stop eating," Twedt says. "Signs of intestinal problems, including intermittent vomiting or diarrhea, are common. Jaundice, or yellow discoloration, may be detectable in the whites of the eye or membranes lining the mouth, and water intake and urine output may be increased."

Dogs affected with copper toxicosis show signs of progressive liver failure, ranging from anorexia, vomiting, weakness, weight loss, lethargy and depression to dehydration, jaundice, abdominal fluid, wasting, excessive urination and thirst, anemia, and hepatic encephalopathy, or end-stage liver disease.<sup>3</sup>

As Bedlington terriers increase in age, their liver copper concentration and severity of disease increase.<sup>2</sup> "The disease tends to either take a short clinical course of illness leading to death, or a slow progression of illness over months or years," Twedt says.

### Pattern of Inheritance

Copper toxicosis is caused by an autosomal recessive defect. Only dogs carrying two abnormal genes — one from each parent — will accumulate excessive copper in the liver and be prone to liver failure. Neither normal dogs nor heterozygotes, those with one abnormal and one normal gene, will accumulate excess copper or show signs of illness.

### Disease Diagnosis

Development of the DNA linkage marker test for copper toxicosis in Bedlington terriers in 1995 provided opportunities to identify homozygous normal, homozygous affected and heterozygous dogs, when sample pedigree information is provided. "Before the DNA test, breeders relied on liver biopsies or test mating strategies to determine whether a dog was clear of copper toxicosis," Yuzbasiyan-Gurkan says. "Test matings in particular were frustrating because by the time a dog was determined to be a carrier, additional affected dogs were born."

With help from breeders, who submitted blood samples of AKC-registered Bedlington terriers, Yuzbasiyan-Gurkan and scientists at Michigan State University successfully located a linked DNA

marker. "This was the first marker to be identified for a canine genetic disease through a whole genome scanning approach using random microsatellite markers," she says. "The result has produced a new era in veterinary medicine, enabling identification of all genotypes in offspring."

Liver biopsy continues to be important for establishing a specific diagnosis, for staging of the disease, and in dogs being considered for breeding. "In cases where there are questionable results — a negative test for copper toxicosis but increased liver enzymes — a dog should be biopsied," Twedt says. "It is important to wait until a dog is 1 year old to conduct a liver biopsy to be sure adequate time has occurred for copper to accumulate."

The DNA marker test has helped reduce frequency of copper toxicosis by providing an effective diagnostic tool. Difficulty in decreasing disease prevalence has been tied to late onset and diagnosis of illness. The marker test makes it possible to develop linkage information in pedigrees with an affected offspring and to provide breeders with information about which dogs are safe to breed.<sup>4</sup>

A long-term study examining prevalence of copper toxicosis in Bedlington terriers in The Netherlands showed a significant reduction in the disease, partly due to use of the DNA marker test. The study, which ran from January 1976 to January 1997, used liver biopsy for diagnosis in dogs evaluated from January 1976 to January 1986, and the DNA marker test was used from January 1990 to January 1997.

Bedlington terriers affected with copper toxicosis dropped to 11 percent from 1990 to 1997, compared with 46 percent from 1976 and 1986.<sup>5</sup> The reduction in The Netherlands was attributed to successful screening of virtually the entire population of Bedlington terriers and selective breeding using the DNA marker test.

### Treatment for Copper Toxicosis

Treatment for copper toxicosis should be tailored to the needs of an individual dog and the severity of copper accumulation. Veterinarians generally recommend screening all Bedlington terriers for copper toxicosis. "It is very important for

the owner and veterinarian to be sensitive to problems that can occur by conducting early screening tests," Twedt says.

"Therapy falls into two categories," he says. "One is for dogs that have no outward clinical signs of liver disease but have abnormal liver copper accumulation, and two is for dogs that are seriously ill with disease."

Therapy may include decreasing further absorption of copper from the intestinal tract by feeding a copper-deficient diet and blocking dietary copper uptake with zinc.<sup>2</sup> Zinc therapy decreases intestinal absorption of copper by inducing synthesis of the copper-binding protein metallothionein.

Another therapeutic approach involves enhancing copper excretion using copper chelator therapy. Copper chelators are effective because they bind with copper in the blood or tissues and promote its removal through the kidneys.<sup>2</sup> An adjunct therapy involves protecting the liver from copper oxidative damage using antioxidants. Vitamin E helps minimize oxidative damage and may have a beneficial effect in dogs with abnormal liver copper concentrations.<sup>2</sup>

### Disease Elimination

Elimination of copper toxicosis from Bedlington terriers requires identifying affected dogs and carriers of the recessive gene and removing them from breeding programs. Early identification of dogs affected with the disease also helps to contribute to longevity and successful disease management. "Some dogs with copper toxicosis live to old age and die with — not because of — the disease," Twedt says. ♦

<sup>1</sup> Twedt DC. Diagnosis and Management of Copper Associated Liver Disease. *The European Journal of Comparative Gastroenterology*. 1997; 2:2.

<sup>2</sup> Rolfe DS, Twedt DC. Copper-Associated Hepatopathies in Dogs. *Veterinary Clinics of North America: Small Animal Practice*. 1995; 25:2, p.399.

<sup>3</sup> Johnson SE. Chronic Hepatic Disorders. *Textbook of Veterinary Internal Medicine: Diseases of the Dog and Cat*. W.B. Saunders Company, New York. 2000; 5:1, p.1298.

<sup>4</sup> Yuzbasiyan-Gurkan V, Blanton SH, Yueying C, Ferguson P, Jianping L, Venta PJ, Brewer GJ. Linkage of a microsatellite marker to the canine copper toxicosis locus in Bedlington Terriers. *American Journal of Veterinary Research*. 1997; 58:1, p.23.

<sup>5</sup> Ubbink GJ, Van den Ingh TSGAM, Yuzbasiyan-Gurkan V, Teske E, Van De Broek J, Rothuizen J. Population Dynamics of Inherited Copper Toxicosis in Dutch Bedlington Terriers (1977-1997). *Journal of Veterinary Internal Medicine*. 2000; 14, p.172.