HIGHER GROUND

Elevation, genetics draw attention in brisket disease studies

By Amanda Radke
Photos courtesy of Greta Krafsur

Ranchers who live and graze cattle at high elevations are well aware of brisket disease. At elevations of 7,000 ft. and higher, there are many cases where low oxygen incites vasoconstriction, which remodels the pulmonary arteries, causing fluid to accumulate in the loose tissue of the brisket, and progressively leads to the dysfunction and failure of the right heart.

While this right heart failure at high elevations is well-documented, it is now recognized as a common cause of death in late fed cattle in high plains feedlots, where there is no history of high altitude grazing.

"It is believed that other risk factors like chronic inflammation and bovine respiratory disease (BRD) may initiate or contribute to disease progression in fat steers," said Greta Krafsur, veterinarian and third year anatomic pathology resident and Ph.D. student at Colorado State University (CSU). "In humans, it's well recognized that persistent inflammation early in life can set off mechanisms in the development of disease. In cattle, persistent inflammation could do the same. In a feedlot setting, that would involve cases like BRD, which is the number one cause of death in cattle. Anything that would cause this inflammation, some cattle will be hyper responders to →

that inflammation. It will set them up for this pathology to cause remodeling in the lungs and cause the right heart to fail."

While at CSU, Krafsur has been focused on finding the pathogenesis of pulmonary vascular remodeling by exploring factors such as genetics to pinpoint which cattle are most susceptible to this progressive dysfunction and failure of the right heart.

"When I started my pathology residency, I wanted a project that entailed both production and disease," said Krafsur. "CSU has a long history of studying brisket disease as it was first described here in 1913 by a veterinarian and veterinarian pathologist. From there, we've learned the inherited susceptibility of brisket disease and realized that bringing the cattle back down to a lower altitude was so impactful for these cattle. What's concerning researchers and cattlemen now is we are seeing more failures in late-term feedlot cattle not at high altitudes."

Telltale Symptons

Krafsur points out a few telltale symptoms of brisket disease including edema in the ventral and brisket areas.

Using her veterinary pathology training, Krafsur is trying to find the causes – environmental and genetic – that may be leading to death loss in feedlots due to pulmonary hypertension. Using hypobaric chambers, Krafsur simulates high altitudes of 15,500 feet and studies the response of neonatal dairy calves to help advance her research of brisket disease in cattle.

She also works closely with human physicians and works in a lab at the University of Colorado Denver Medical School. She often gets calls from ranchers who donate these late-term feedlot steers who suffer a death loss due to pulmonary hypertension, and she's been able to connect the dots from bovines to people in a cross study that has benefited both cattle and human health.

"In the population of cow-calf operations at high altitudes, when reduced oxygen causes hypoxia, the blood vessels will fail and constrict and not shunt blood elsewhere," said Krafsur. "I think it's very well understood and described, but in the feed lots and low elevations, it's very complicated. A human doctor at Vanderbilt has identified possibly one genetic market for this after studying blood samples from some of our research cattle. However, we know that

> *"...we are seeing more failures in late-term feedlot cattle not at high altitudes."*
>
> – *Greta Krafsur*

there are multiple genes involved, and it will take some time to identify these genes."

Jim Myers, DVM, a veterinarian at the Belle Fourche Veterinary Clinic, started recognizing this problem in some of his clients' fat cattle long before researchers started looking at the problem. While it's rare for cattle in his area to suffer from this disease – largely because of the low elevation and the small number of feedlots in the area – he says for producers who retain ownership and send their cattle on to feedlots, there have been several instances of death loss for evaluation.

"We had cattle from the Belle Fourche area go to a slightly higher elevation in

→

feedlots in the western slopes of Nebraska that have suffered from pulmonary hypertension and death," said Myers. "You wouldn't think the slight elevation increase would be a huge deal, but when these cattle get fat, it puts more stress on their circulatory system. As a result, the heart has to pump blood farther because of the additional blood vessels. Once they get up to the last month of their life in the finish phase, all of a sudden, several steers are dying at once. This often happens in cattle that come from the same producer, so it's an indication to me that there might be a genetic predisposition to this disease."

To identify the cattle most likely to succumb to pulmonary hypertension, Myers said many veterinarians administer Pulmonary Artery Pressure (PAP) tests on bulls for seedstock producers in high elevations.

"For purebred breeders in the high country of Wyoming and Colorado, a PAP test is necessary to provide bull scores to customers," said Myers. "The theory on interpreting the numbers is if a bull doesn't have a good PAP score, then he will also pass that trait onto his offspring."

PAP testing involves passing a catheter through the right jugular vein into the right heart and measuring the pressure.

"The test doesn't require sedation; the bulls are just run through the chute and the pressure is

measured," said Myers. "This test isn't done with regularity, but in areas where cattle graze in high altitudes, this information is important for seedstock producers to collect and pass onto the commercial producers who will be using their genetics."

"Generally, it's best to test for the altitude the cattle will reside at," added Krafsur. "PAP testing essentially measures how hard the blood is being forced through the heart. Generally, we want a bull to receive a sore below 40; this would mean he would do well at a high elevation, as would his offspring. Any score between 41 and 48, producers should exercise caution. Anything over 49 would be considered a failed test, and this would not be a good choice for a high elevation operation."

Krafsur says the heritability is estimated to be as high as 30-40 percent. With the identification of the genes responsible for higher instances of pulmonary hypertension, she hopes the industry will one day develop genomic EPDs to help folks make the correct breeding decisions based on the scores.

In these hypobaric chambers, Greta Krafsur simulates an altitude of 15,500 feet and studies the response of neonatal dairy calves to help advance her research of brisket disease in beef cattle.

Photo courtesy of Greta Krafsur

"In addition to PAP scores, more work needs to be done to develop both the genomic factors and inflammatory biomarkers of this disease," said Krafsur. "This is definitely on the rise in feed lots, and owners are very concerned about this."

"With the introduction of genetic profiling, the amount of information we now have at our fingertips about the DNA of cattle is phenomenal," added Myers. "If there is a genetic component to pulmonary hypertension, I imagine we will soon find it. Genomics is still in its infancy, and the industry is just getting started."

Chronic inflammation and certain genetic markers may be the cause of pulmonary hypertension in late-term feedlot steers at low elevations. This steer is showing symptoms with fluid in his brisket, abducted limbs, and being isolated from the group.

So what are pen riders seeing for symptoms of cattle before the onset of death in these feedlot cattle? Krafsur says there are several signs of trouble, but the problem is the symptoms don't last long before death occurs.

"Cattle will isolate themselves and generally stand alone by the water tank," said Krafsur. "Limbs are abducted (abnormally away from their body and chest). The cattle exhibit labored breathing. There is an accumulation of fluid under their mandibles, particularly the brisket. The steer will have watery diarrhea and is typically a poor doer."

"The blood pressure gets so high, it actually pushes the fluid out of the vessel," added Myers. "The heart is too overworked to circulate the blood properly, and within a day or two, the steer is dead. It's not uncommon to miss these →

symptoms and simply find a dead animal in the lot."

In the lab at South Dakota State University (SDSU), Dale Miskimins, DVM, MS, a veterinary pathologist and Extension veterinarian has studied cases of pulmonary hypertension submitted by ranchers.

"In cases like this, we first notice changes in the heart muscle, as well as the lungs," said Miskimins. "Clinically and microscopically, a case of brisket disease at high elevation looks very similar to low altitude pulmonary hypertension."

In necropsies of these cattle, other signs will be an aneurysm of the artery, lungs filled up with fluid, and jugular veins bounding and extremely wide. An ultrasound of carcass characteristics would also show a much smaller ribeye when compared to other steers in the lot as the animal has failed to thrive.

"This syndrome is not yet understood because it's a new and different syndrome from brisket disease," said Miskimins. "We are trying to educate our clients and other veterinarians to look for this syndrome and recognize the signs that this has occurred in a death loss. At SDSU, we are watching the work of Krafsur at CSU very closely, as well as some data that's being gathered at Kansas State University."

If and when Krafsur is able to identify the genetic markers, Miskimins said these cattle can be more easily identified to market them lighter and avoid both death loss in the fat steer and financial loss for the feeder.

"We are excited that researchers like Krafsur are working so diligently to identify these genetic markers," said Miskimins. "She's a very outgoing and brilliant pathologist and veterinarian, and she is a South Dakota native. We hope she might one day return home and work at the SDSU diagnostics lab."

Greta Krafsur gets blood from the jugular vein in a late fed steer with pulmonary hypertension in Akron, CO.

Looking for Answers

Krafsur hopes to use background, education to help beef industry

Veterinarian and pathologist Greta Krafsur has dedicated her Ph.D. research to studying pulmonary hypertension. Here she poses with the neonatal dairy calves she evaluates using hypobaric chambers in simulations of 15,000 ft.

By Amanda Radke
Photos courtesy of Greta Krafsur

Each year, the National Cattlemen's Foundation (NCF) awards two $12,000 scholarships to outstanding students who are pursuing careers in meat science and animal agriculture. The scholarship is given in honor of W.D. Farr — the first NCF president and president of the American National Cattlemen's Association, which later changed to the National Cattlemen's Beef Association (NCBA).

Farr was well known for his work in the livestock industry, water development and production agriculture. Having passed away at age 97 in 2007, the W.D. Farr Scholarship recognizes superior →

achievement in agricultural studies and supports graduate students in their studies, with the hope that their work will ultimately benefit the beef industry.

This year's winners are Whitney Crossland of Texas A&M University and Greta Krafsur of Colorado State University (CSU). Krafsur is a native of Estelline, S.D. and is passionate about her work studying pulmonary hypertension in cattle and the potential genetic markers that lead to cattle dying of brisket disease even at areas of low elevation.

"We had over 35 applicants for this year's scholarships representing 16 universities from across the country," said Sara Arp, NCBA manager of leadership management. "Speaking on behalf of the NCF committee, Greta is an outstanding person who has a lot of experience in her educational career and personal life. She is looking at something that will benefit the beef industry, not only from a cow-calf side but on the feeder side."

Krafsur is currently a Ph.D. student at CSU and is using her veterinary pathology training to explain the development of bovine high-mountain disease, more commonly known as brisket disease.

"My hope is to identify the biomarkers associated with the phenotype that can be used to predict disease risk, with the goal of improving selective breeding, precondition, and fattening regimens," said Krafsur.

Listening to Krafsur passionately speak about her research, it's hard to imagine her doing anything else. However, her career in the beef industry hasn't been linear. After graduating from Estelline High

School in 1986, Krafsur pursued her bachelor's and master's degrees in textiles and clothing and textile engineering. While studying for her master's at the University of Tennessee at Knoxville, Krafsur started to miss home, particularly rural living and the agricultural industry that she grew up in. She fondly remembers her childhood spent on her family's diversified crop and cattle operation. Soon, she began dreaming of becoming a veterinarian, but as she says it, "Life got in the way."

While in school, Krafsur met her husband David, and they went on to have three children, Joseph (age 17) and twins Benjamin and Joshua (age 16). She stayed home with her boys until they went to kindergarten, and it was then that she began her veterinary medicine training at Colorado State University.

"I went back to school in 2005 and completed two and a half years of pre-requisites before applying to vet school in 2008," she said. "I started school in August of 2009 and graduated as a veterinarian in 2013. From there, I started my residency at CSU. I started vet school with the intention of becoming a pathologist and have been working to get necropsy experience while I'm in school."

Krafsur has spent summers in Alaska, doing necropsy work on whales and seals to give a baseline health assessment of these animals before human consumption. She also spent six weeks in Scotland, where she traveled to local small farms performing veterinary →

work as needed. A highlight of her trip was doing a C-section on a Simmental cow and delivering a healthy set of twins.

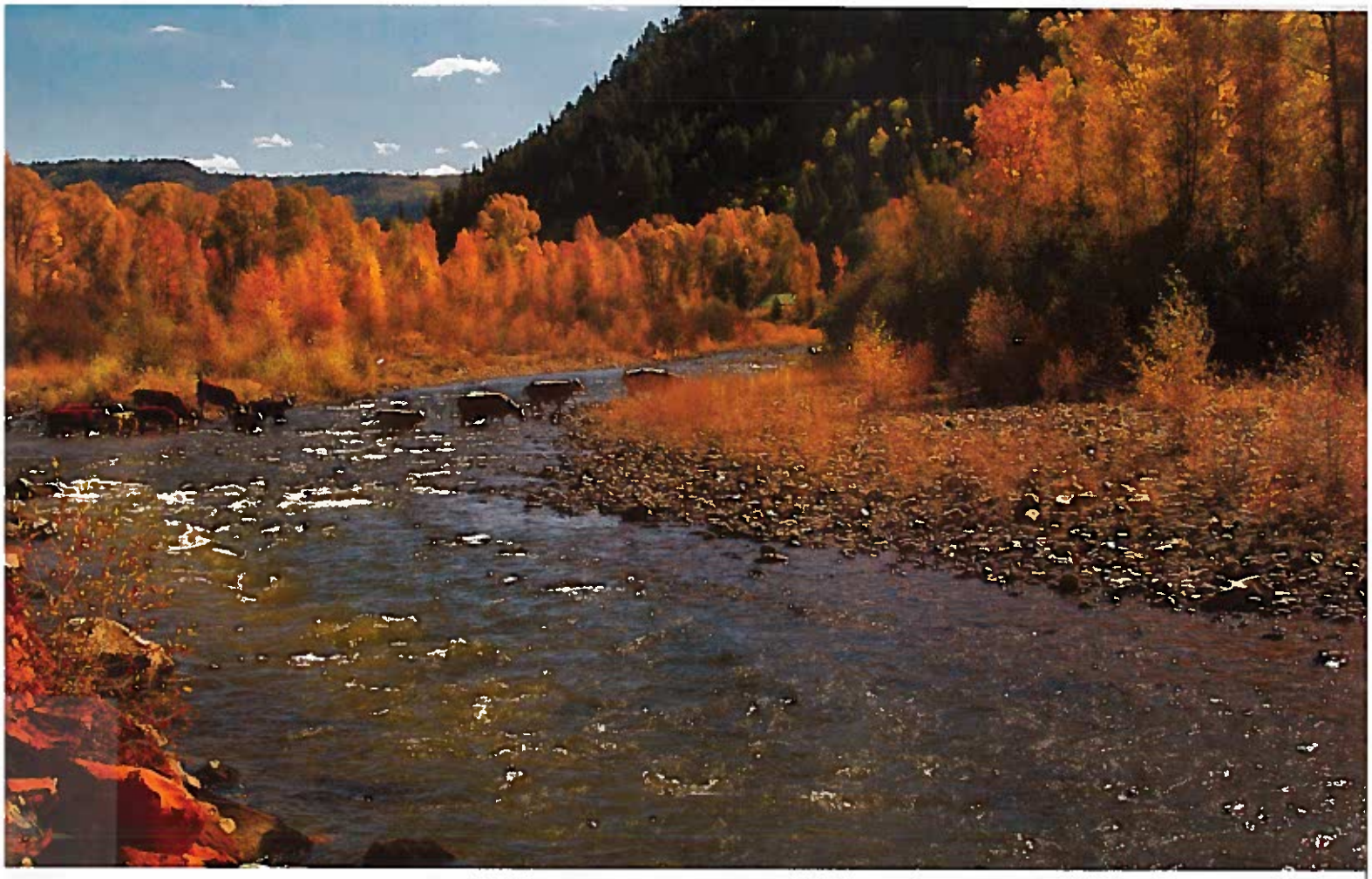
While she still has a few years left at CSU, the timing will also coincide with life and her family. She will complete her residency around the same time as her twins graduate from high school, and she hopes to return home to South Dakota, where she will start her own cow-calf operation on the family ranch in Estelline and work as a veterinary pathologist on important research such as the brisket disease work that has been her focus now for several years.

"My dream job would be to practice on large animals and be a consulting pathologist to feed yards and cow-calf operations," she said. "Because of my specialty in brisket disease, I would like to continue my research in that field and continue to run experiments to learn more about it."

Krafsur works closely with beef industry professionals as well as human health professionals in this area of study, which she says has been incredibly rewarding for both parties.

"In my research, I collaborate quite a bit with human physicians because cattle make an incredible model for human pulmonary hypertension," said Krafsur. "The human MDs I present to are amazed at how closely bovines line up to humans. The information has benefited both beef cattle and humans greatly."

Krafsur will accept the W.D. Farr Scholarship



in January at the 2016 Cattle Industry Convention & NCBA Trade Show in San Diego, CA.

"After reading Farr's story, I was very inspired by his life and background," she said. "After applying, I figured I didn't have a prayer since I'm just a veterinarian, but I gave it a shot any way. It was very humbling to learn I received this scholarship. You can't drive around Colorado and not think about Farr's impact on the beef industry. I'm truly honored to receive this award."

"The NCF is always look for opportunities to help advance the future of the beef industry, and this scholarship definitely aims to support great minds in the beef industry," said Arp. "W.D. Farr was such an innovator, and this is such a prestigious award. These individuals could potentially be the next Farr, and it's important for our industry to support these individuals who can help advance the beef business."

For Krafsur, winning the W.D. Farr Scholarship is certainly a feather in her cap, but she's going to continue to focus on the research that matters to her, with the hopes of changing the ways beef producers select, breed and retain cattle genetics in the future.

"Ultimately, my goal is to be able to identify the genes and circulating bio-markers to know the phenotype that would be most likely to develop brisket disease, so cow-calf producers can make breeding decisions," she said. "By the time the animal gets to the feed yard, it's too late."

Ranch Tested.
Rancher Trusted.

- Lower Maintenance Energy Requirements
- Easy Fleshing
- Improved Stocking Rates
- Higher Pregnancy Rates
- Extended Productive Lifespan
- Easy Calving
- Docile Disposition
- Unbiased, Reliable EPDs

Building Better Beef...

South Dakota Red Angus

(605)350-0076 • www.southdakotaredangus.com

Check out theses SD Red Angus shows and sales!

January 28 - Sioux Empire Farm Show
February 4 - Black Hills Stock Show
February 10 - Watertown Winter Farm Show