



## Hay Feeding and Storage: 'Tis the Season to Cut Expenses



COURTESY KRISTA LEA

**Hay feeders can help reduce feed waste to as little as 5 to 10%, depending on the feeder and hay type.**

One of the most labor-intensive aspects of horse ownership is winter hay feeding. Most U.S. horse owners must feed hay at some point because pastures are no longer growing, are limited in quantity, or horses are confined to sacrifice paddocks.

Hay production across the U.S. is valued at more than \$12 billion annually. However, hay losses during storage and feeding represent a significant expense for horse owners. Proper hay storage and feeding can reduce these losses and preserve forage quality for your horse.

### Storage

Losses during storage can result from decreases both in bale weight and in forage quality. Several factors, including type and size of bale, storage method, and weather conditions can contribute to losses.

Larger, densely baled packages generally suffer less loss than those in smaller

or loosely packed bales because of the reduced surface area and improved ability to shed water.

Where you keep your hay is also a major factor in storage-related losses. Research indicates that bales stored outside on the ground can lose up to 43% dry matter compared to just 2% when stored in a pole barn. Moisture affects bales stored outside by increasing microbial activity, and rain can leach nutrients such as soluble carbohydrates, leading to lower digestibility. These losses are more likely to impact legumes (alfalfa and clover) than grass hay.

Small square bales should be baled tightly and uniformly in size to aid in

stacking. Ideally, bales should be stored on gravel, pallets, or using any other method that reduces moisture-wicking from the ground or floor. If stored outside, bales should be covered with a large waterproof tarp.

Round bales should also be baled with consistent size and density. Covered storage that also limits moisture from the ground is ideal, but outside stored bales can be stacked and covered. If stored without cover, bales should be lined up tightly end-to-end, and their rounded sides should not touch others. Bales stored outside sans cover must be able to dry as quickly as possible after rain, so do not store them in the shade or under trees. Net-wrapping bales could help reduce weathering and losses during handling compared with securing them with traditional string or twine.

All other factors being equal, outside stored hay should be fed before inside stored hay to reduce losses.

### Feeding

Researchers know that trampling, refusal, and deterioration can all result in significant hay losses during feeding—from 25% to upward of 60% when no effort is made to mitigate these risks.

When owners feed hay on the ground, horses often walk over or even lay in it. This leads to contamination with dirt, mud, manure, and urine, all of which

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**HAY FEEDING AND STORAGE**

PHOTOS COURTESY KRISTA LEA

**Slow-feed haynets help reduce waste while increasing the time it takes horses to finish hay.**

can increase feed refusal and losses.

Horses typically pick through hay to find the leafiest pieces while refusing other less appetizing ones. While some feed selection can be helpful—such as to avoid moldy spots or coarse stems—horses can ultimately reject good parts of the bale.

Additionally, hay fed outside is exposed to the same weathering factors as hay stored outside. Physical dry matter losses are common, as is forage quality loss due to leached nutrients.

Feeding hay frequently in small amounts requires more labor but generally encourages horses to refuse less, reduces losses from weathering, and provides fewer opportunities for hay contamination.

**Hay Feeder Selection**

Aside from feeding smaller hay portions more frequently, owners can reduce losses further by using hay feeders. These can help reduce feed losses to as little as 5 to 10%, depending on the feeder and hay type.

The feeder type you choose will depend on the hay you feed. But there are some basic considerations that span all feeder selections.

One question to ask: How much does the feeder restrict the horse's hay access? Feeders that prevent horses from pulling large amounts of hay from a bale and then dropping it on the ground outside the feeder generally have a lower waste factor.

Roll-bale feeders with the hay in a slow-feed net, like the one pictured above, reduce how much and how fast the horse can eat and also significantly control waste.

Another consideration: Is the feeder safe for horses? Look for well-built products with smooth edges.



**The "hay hut" feeder keeps hay protected from the elements while allowing easy access for horses.**

The “hay hut” feeder, which is gaining popularity with owners, is designed to protect hay from weather and reduce waste simultaneously. Horses can easily put their heads in to eat and, while they might remove some hay while eating, losses are typically limited.

Also consider how easy—or difficult—the feeder is to refill, as you'll be doing this task regularly. When filling the feeder, don't overfill it. While it might seem like you're maximizing efficiency, an overstuffed feeder can ultimately restrict feed intake and result in more hay being pulled out of the feeder and wasted.

**The Bottom Line**

Selecting and using a feeder that works for you and your horses reduces waste and helps you save on feed costs. Feeder use reportedly helps owners save enough on feed bills to cover its cost in two to nine months. And, once the feeder is paid for, it is available in subsequent years and will help owners keep feed costs lower in the future. [UK](#)

>Krista Lea, MS, research analyst and coordinator of the University of Kentucky (UK) Horse Pasture Evaluation Program in the department of Plant and Soil Sciences; Ray Smith, PhD, professor and forage extension specialist in the department of Plant and Soil Sciences; and Bob Coleman, Ph.D. PAS Dipl ACAS-Nutrition, associate professor in equine extension in the department of Animal and Food Sciences, provided this information.

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## Small Size, Big Deal: UK Welcomes New Miniature Stallion

**S**tanding at 34 inches tall, Little Kings Buckaroo Renaissance has a presence that dwarfs his physical small stature.

"Renny," a Miniature Horse, was donated to the UK Gluck Equine Research Center's parasitology research herd this spring. His job, as the all-important herd stallion, is to ensure genetic diversity and improve herd health.

Ed and Marianne Eberth, who own Little King Farm, in Madison, Indiana, have a long history of working with the Gluck Center and furthering Miniature Horse breeding and genetics research. Before they donated Renny, they'd donated a herd of Miniature Horses—along with the stallion Komokos Wee Willie—in the early 1980s to start the research herd with Gluck Center researchers Tom Swerczak, PhD, and Gene Lyons, PhD.

Martin Nielsen, DVM, PhD, Dipl. ACVM, associate professor and Schlaijkjer Professor of Equine Infectious Disease at the Gluck Center, now manages this unique historic herd.

"This herd has been used to test and evaluate different deworming regimens over the years," Nielsen said. "Dr. Lyons has documented how drug-resistant parasites emerged in response to regular

recommended treatments.

"The herd now harbors multiresistant parasites, which is a good model for what is going on in private and commercial horse operations all over the world. This gives us a unique opportunity to identify the best deworming regimen for horses with already resistant parasites."

A resident stallion has always lived in the herd year-round. So when UK needed a new one, the Eberths carefully selected Renny—one of their top stallions—with the help of their son John, a PhD candidate at the Gluck Center. During his time at UK he has discovered the four genetic mutations that cause dwarfism in Miniature Horses, which ultimately led to genetic dwarfism tests being developed.

"Once I discovered the mutations associated with chondrodysplastic dwarfism in Miniatures while here at Gluck, I worked with Dr. Nielsen and had the descendants of the original herd (used today) genetically tested and worked with my mom again in finding a stallion that was negative for the dwarfism mutations," John Eberth said.

"Dwarfism in Miniature foals causes several health issues, and foaling can be very complicated and put a lot of unnecessary stress on the foaling mares. Donating a stallion that is negative for chondrodysplastic dwarfism in Miniatures ensures the long-term reproductive and genetic health of the parasitology herd used for research at UK," he added.

Nielsen added, "Renny is a prime stallion with excellent bloodlines and looks. What a handsome fellow he is! We now

have a breeding program to effectively eliminate dwarfism from the herd and ensure healthy Minis going forward."

Renny, foaled in 2006, started his career as a harness horse. But, due to his desirable bloodlines and disposition, his value as a breeding stallion surpassed that of his show career, so he joined Little King Farm's breeding herd. His bloodlines are well-known in the Miniature Horse industry and include numerous national and world champions, including his sire, Boones Little Buckeroo, who holds the unequaled record of winning three National Grand Champion Senior Stallion titles.

The buckskin stallion is known for his good looks and has a tendency to always pose for photos. He's easily identifiable by his deep and intelligent eye, tight and attentive ears, an expressive lower lip, and his signature head toss and mane swish. Like other horses from Little King Farm, Renny was bred to have the proportion and movement of a full-size horse.

Robin Mingione, Marianne Eberth's daughter, who manages Little King Farm's sales and events, said, "We hope he finds himself as valuable for UK as he was for Little King Farm and the Miniature Horse industry." **UK**

➤Samantha Geller, a senior double majoring in equine science and management and environmental and sustainability studies, is a communications intern with UK Ag Equine Programs and Gluck Equine Research Center.



JENNY EVANS

"Renny" is the new resident stallion in the Gluck Center's parasitology research herd of Miniature Horses.

## Researchers Publish Study on Dwarfism in Miniature Horses

John Eberth, PhD candidate and researcher in the genetics laboratory at the UK Gluck Equine Research Center, published results from work he conducted on dwarfism in the July issue of *Animal Genetics*, an international journal of immunogenetics, molecular genetics, and functional genomics of economically important and domesticated animals.

Eberth conducted the study, "Multiple alleles of ACAN associated with chondrodysplastic dwarfism in Miniature horses," with Kathryn Graves, PhD, professor and director of the Animal Genetic Testing and Research Laboratory; James MacLeod, VMD, PhD, John S. and Elizabeth A. Knight Chair and professor; and Ernest Bailey, PhD, professor, all from the Gluck Center.

Eberth and colleagues found mutations in the gene aggrecan—the major structural protein of cartilage associated with dwarfism in Miniature Horses. This research also allowed the team to develop tests to identify dwarfism in Miniature Horses.

Dwarfs have defects that can seriously affect their health, including breathing problems, malformed mouths that cause eating difficulties, and abnormal bone growth leading to chronic soundness issues.

"John and his family bred Miniature horses, and dwarfism was a problem for the entire breed. His fascination with genetics and desire to solve this problem drove his research," Bailey said.



**Dwarf horses have defects that can seriously affect their health, including breathing problems, malformed mouths that cause eating difficulties, and abnormal bone growth leading to chronic soundness issues.**

Eberth grew up on his family's farm foaling mares, riding, training, assisting with surgeries, and managing horses. When he was a teen, his family's business grew to become one of the largest Miniature Horse breeding programs in the world. During that time, he observed instances of genetic anomalies, including dwarfism. After Eberth took his first genetics class in college, he was hooked.

"I wanted to immediately look into dwarfism in the Miniature Horse," he said. "Initially, Dr. Bailey and I hypothesized that mutations in many different genes would account for the diversity dwarf phenotypes observed. However, once DNA samples were sequenced from the different phenotypes, it became clear that the situation was quite different. A single gene, with four different mutations, was responsible for dwarfism ranging from embryonic loss to grossly malformed foals to viable foals with deformed conformation and health problems characteristic of this form of dwarfism."

After the team completed the study, the UK Animal Genetic Testing and Research Laboratory commercially released the test to detect dwarfism gene carriers.

Find the study at [doi.org/10.1111/age.12682](https://doi.org/10.1111/age.12682). 

>Samantha Geller, a senior double majoring in equine science and management and environmental and sustainability studies, is a communications intern with UK Ag Equine Programs and the Gluck Equine Research Center.

## GRAD STUDENT SPOTLIGHT

### PARUL SURI

**From:** Delhi, India

**Degrees and institutions where received:**

**BS in biotechnology, India**

**MS in biological sciences, St. John's University, New York**

Originally from Dehli, India, Parul Suri, MS, worked for Zoetis in Michigan for two-and-a-half years after earning her master's degree. During that time, she learned about projects that Gluck Equine Research Center researchers were conducting. Suri's research interests matched perfectly with the studies underway at the Gluck Center, so she decided to pursue her PhD in Lexington, Kentucky.

Suri is working under the direction of Daniel Howe, PhD, molecular parasitologist at the Gluck Center. Her research is mainly focused on *Sarcocystis neurona*, a neural parasite that can cause the neurologic disease equine protozoal myeloencephalitis (EPM) in horses. She is investigating the molecular mechanisms *S. neurona* uses to cause EPM.

When asked what her most valuable takeaway was from the program, Suri said, "The innovative and creative mindset of people involved in research in this program makes it more unique for students who want to enhance their critical thinking. It acts like a step forward to becoming an independent researcher with valuable skills and knowledge."

She plans to graduate in 2022 and then pursue a postdoctoral position either in equine or human parasitology. 

>Alexandra Harper, MBA, is the operations and communications coordinator for UK Ag Equine Programs.



## Improved Map of Horse Genetic Code Released

Researchers at UK and the University of Louisville (UofL) have produced a more complete picture of the domestic horse reference genome, a map scientists will use to determine the role inherited genes and other regions of DNA play in many horse diseases and traits important in equine science and management.

By re-analyzing DNA from Twilight, a Thoroughbred mare who served as the basis for the original horse reference genome, scientists generated a more than tenfold increase in data and types of data to correct thousands of errors in the original sequence. Since researchers published the original genome in 2009, there have been dramatic improvements in nucleotide sequencing technology and the computational hardware and algorithms used to analyze data. It is now easier and less expensive to build a reference genome.

The new equine reference genome, called EquCab3.0, was published in *Communications Biology*, representing the work of 21 co-authors from 14 universities and academic centers around the world. The horse reference genome is publicly available through the National Center for Biotechnology Information, a division of the National Institutes of Health, at [ncbi.nlm.nih.gov/genome?term=equus%20caballus](https://ncbi.nlm.nih.gov/genome?term=equus%20caballus).

Genome sequencing allows researchers to read and decipher genetic information found in DNA and is especially important in mapping disease genes—discovering diseases a horse might be genetically predisposed to developing.

Data gathered from future genetic and genomic studies of horses will use the new reference as a basis, which also has implications for tackling serious diseases in humans, said principal investigator Ted Kalbfleisch, PhD, of the UofL School of Medicine Department of Biochemistry and Molecular Genetics.

"Because we can sequence a horse and map it to the reference genome, we can know what genes might be affected by a mutation and come up with a hypothesis for what went wrong," he said. "Looking beyond the horse, we all want to cure cancer and other diseases that affect humans. Being able to accurately generate reference genomes gives us the tool that we need to map an individual's genomic content."

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**By re-analyzing DNA from Twilight, seen here, scientists corrected thousands of errors in the original sequence that was released in 2009.**

Having a high-quality reference genome makes it possible for us to know where an individual has a mutation and personalize therapies that will be right for an individual and the specific disease they have."

Senior author James MacLeod, VMD, PhD, of the UK Gluck Equine Research Center added, "Increased accuracy of the horse reference genome achieved through this work will greatly facilitate additional research in many aspects of equine science. Medical advances for horses as a

patient population, both in terms of sensitive diagnostic tests and emergent areas of precision medicine, are addressing critical issues for the health and wellbeing of these wonderful animals."

The Morris Animal Foundation, the United States Department of Agriculture, and several additional grants to the laboratories of individual co-authors provided financial support for the research. 

>Edited press release from UofL and UK.

## USEF, UK Partner to Develop Equine Drug Testing Laboratory

The United States Equestrian Federation (USEF) and UK have signed a letter of intent to develop an equine regulatory testing laboratory in Lexington, Kentucky, the federation announced Oct. 31.

In January 2018, the USEF Board of Directors appointed a task force headed by Tom O'Mara to work with senior leadership to analyze USEF's laboratory functions and future options for their sample testing program. The creation of the task force led to conversations with the university regarding potential collaborations. The USEF Board of Directors met on Oct. 3 and unanimously approved the signing of this letter.

"Our senior leadership and task force have done a fantastic job of analyzing our laboratory and equine testing program," said USEF President Murray Kessler. "The recent announcement by the UK College of Agriculture, Food and Environment that Scott Stanley (PhD) will be joining their faculty in January provides a unique opportunity for UK to



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build upon the foundation of the USEF laboratory and expand the program under the direction of a leading expert in this field. This arrangement will provide USEF members with state-of-the-art equine testing, research, and the independence between the laboratory and the USEF regulatory process."

The lab will expand upon UK's expertise in equine pharmacology and toxicology. Additionally, this partnership builds on the college's mission of serving Kentucky and the world through unparalleled teaching, transformative research, and relevant service.

"We are excited about our partnership with USEF," said Nancy Cox, MS, PhD, dean of the UK College of Agriculture, Food and Environment. "Dr. Stanley has an international reputation for sound application of the best technologies to pharmacology in the horse. Under his leadership, the lab will enhance our ability to provide state-of-the-art dedicated service to the health and welfare of the horse."

The USEF and UK expect to finalize the details of the agreement in the near future. **UK**

>Edited press release from the USEF.

## Horses Teach Health Care Students Leadership Competencies

For five years, the UK Center for Interprofessional Healthcare Education and Research has been sending medicine, nursing, physical therapy, dentistry, and public health students to work with horses as part of their semester-long Leadership Legacy Program.

Lissa Pohl, MA, program and outreach associate in the Department of Community & Leadership Development, and master trainer for the Equine Experiential Education Association, has facilitated workshops for up to 24 students per year teaching self and social awareness (emotional intelligence), intention, presence, and patient-centered care.

Jason Parmer, of Dapper Agency for UK's College of Nursing, created a video to demonstrate how powerful this type of experiential learning is in teaching competencies that support effective communication and relationships across health care professions. Many thanks to Janie Heath, PhD, APRN-BC, FAAN, dean of the College of Nursing, and James C. Norton, PhD, for allowing us to share this video with those interested in equine-assisted learning. **UK**

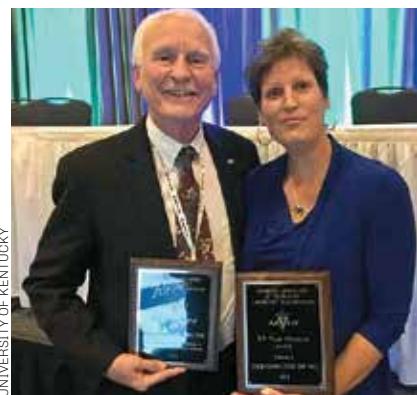
View the video at [youtu.be/IjL98c\\_LiF8](https://youtu.be/IjL98c_LiF8).

>Lissa Pohl, MA, program and outreach associate in the Department of Community & Leadership Development, provided this information.



## UK Veterinary Diagnostic Lab Director Receives National Honors

Craig Carter, DVM, PhD, Dipl. ACVPM, director of the UK Veterinary Diagnostic Laboratory (VDL), recently received two prestigious awards from the American Association of Veterinary Laboratory Diagnosticians (AAVLD) at its annual meeting, held Oct. 18-22 in Kansas City, Missouri.



**Dr. Craig Carter received the E.P. Pope Award and the AAVLD Life Member Award from the American Association of Veterinary Laboratory Diagnosticians**

The E.P. Pope Award, named for one of the association's founders, is the highest award the AAVLD bestows. Carter received it for his noteworthy and significant contributions to the association related to implementing and advancing veterinary diagnostic lab medicine.

Additionally, Carter, also professor of epidemiology for the UK College of Agriculture, Food and Environment and the UK College of Public Health, received the AAVLD Life Member Award to recognize his nearly 39 years of contributions to veterinary diagnostic laboratory medicine.

"I am humbled to receive these two awards on behalf of everyone in the AAVLD and especially my faculty and staff at the UK Veterinary Diagnostic Laboratory for all their hard work every day to improve and maintain the health and welfare of animals and public health in the commonwealth," he said. "Many folks are not aware that our lab is open seven days a week

**CARTER RECEIVES NATIONAL HONORS**

to serve our clients. Our faculty and staff's commitment to their work is nothing short of amazing—they make me look good every day.

"I am also so grateful to the entire administration of the College of Agriculture, Food and the Environment, to UK, and to our clients and stakeholders for their unwavering support in the sustainment and accomplishment of our laboratory mission," he said. "Finally, I thank my wonderful and beautiful wife, Ronda, for believing in me and supporting my career aspirations all these years."

Carter earned a bachelor's degree, master's degree, doctor of veterinary medicine degree, and doctoral degree from Texas A&M University, in College Station.

After veterinary school, he ran a large animal ambulatory practice in Texas for five years and then later joined the Texas Veterinary Medical Diagnostic Laboratory as a clinical associate, where he created a Department of Epidemiology and Informatics to advance reporting and epidemiology services for the laboratory and its clients.

In 2005, UK recruited Carter to serve as a full professor of epidemiology and, in 2007, UK appointed him director of the UKVLDL.

His research interests include infectious disease epidemiology, antimicrobial resistance, electronic animal health monitoring, computer-based clinical decision support, and laboratory information systems. He has worked as a veterinary and public health consultant in more than 30 countries.

Carter's military career in the U.S. Air Force and the U.S. Army spanned four decades. During his military service, he completed four wartime deployments. He commanded the first Army Reserve Veterinary unit into Afghanistan after the 9/11 attacks and retired as a colonel in 2009.

He received the American Veterinary Medical Association International Veterinary Congress Prize in 2016. Carter is a diplomate of the American College of Veterinary Preventive Medicine and a distinguished scholar of the National Academies of Practice.

The UKVLDL's mission is to develop and apply state-of-the-art diagnostic methodology to improve animal health and marketability, protect the public health, and assist in the preservation of the human-animal bond through the principles of One Health. The UKVLDL is fully accredited by the American Association of Veterinary Laboratory Diagnosticians. **UK**

**>Aimee Nielsen is an agricultural communications specialist within UK's College of Agriculture, Food and Environment.**

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## Climate and Vector-Borne Equine Diseases

A year of above-average rainfall for the commonwealth of Kentucky reminds us of the risk of human and horse exposure to various vector-borne diseases. Some of these diseases are mosquito-transmitted and some tick-transmitted. In any year temperatures and seasonal rainfall can greatly influence the bionomics of these arthropods (how they adapt to their environment).

Researchers have recognized for a significant number of years that a country's climatic conditions can fluctuate greatly due to phenomena such as El Niño. For instance, a number of years ago scientists conducted a retrospective study on the frequency of major African horse sickness epizootics (outbreaks that could potentially affect humans) in the Republic of South Africa. (This disease is spread by *Culicoides* midges.) They found that all but one of these historically recorded events since the early 19th century occurred in El Niño years. The U.S. climate has been similarly affected in such years.

Mosquito and tick populations respond



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## CLIMATE AND VECTOR-BORNE EQUINE DISEASES

very favorably to above-average rainfalls and increased temperatures. Such conditions are conducive to rapid and explosive surges in mosquito populations and the frequency of diseases they transmit. Increased temperatures also enhance the longevity of adult vector populations, while humidity and rainfall have been shown to influence vector behavior and survival.

In a recent report the Centers for Disease Prevention and Control stated that the number of people who contracted diseases transmitted by mosquito, tick, and flea bites has more than tripled in the U.S. in recent years. It says that warmer weather is an important cause for the surge in reported cases. One might well question whether we've observed an analogous



**Above-average rainfall and temperatures are conducive to rapid and explosive surges in mosquito populations and the frequency of diseases they transmit.**

trend in the annual number of vector-borne diseases reported in equids. The most significant mosquito-transmitted diseases in the U.S. that can affect horses are Eastern equine encephalomyelitis (EEE) and West Nile encephalitis (WNE). Every year we see a varying number of horses diagnosed with one of these diseases. The annual incidence of EEE cases over the past 15 years has ranged from 60 (2011) to 712 (2003), with an annual average of 206 cases. Most recently, veterinarians reported 86 cases in 13 states in 2017. These data do not provide evidence supporting an increased frequency of EEE over the last several years.

Unlike EEE, which occurs principally in the Gulf and Atlantic coastal states and the Great Lakes region, WNE has occurred in 48 of the 50 states. Based on cases recorded

in equids since 1999 (the year the causal virus was first discovered in the U.S.), the yearly WNE case incidence has ranged from 60 (2000) to as high as 15,257 at the height of the epizootic in 2002. Over the past 10 years the average annual number of cases has been 272. In 2017 veterinarians recorded 307 cases in 39 states. Similar to EEE, there is no evidence of a significant increase in the frequency of reported U.S. WNE cases in recent years.

While there is also no indication of an upward spiral in the number of EEE or WNE cases in equids over the last 10-plus years, this situation could change significantly and dramatically. Warmer temperatures in conjunction with increased annual rainfalls related to climatic phenomena have the potential to give rise to not only increased vector populations and longer seasons of vector activity but also a broader geographic range of ecological habitats that could support mosquito species that transmit EEE, WNE, and other arboviral diseases.

Tick-borne diseases represent a very important group in any consideration of climate's effects on vector-borne disease frequency. Scientists have implicated different genera and species of ticks as transmitting an increasing number of diseases. The same climatic conditions and changes that favor mosquito ecology are also relevant to ticks. This is well-exemplified by Lyme disease, a very important tick-borne spirochetal disease of humans, horses, and dogs. We have undisputed evidence that the tick species that transmits the causal bacterium *Borrelia burgdorferi* is increasing in distribution in the eastern U.S. and the Upper Midwest, thriving in regions previously considered too cold for them to survive. Confirmed cases of the disease are rising steadily. Furthermore, traditional periods of tick activity are likely to extend with the advent of more favorable conditions via warmer temperatures and increased rainfall.

If current climate changes continue we might face an increased risk of these diseases in equids, be they mosquito- or tick-transmitted. Accordingly, owners and their veterinarians should make every effort to use preventive strategies, such as vaccination, to reduce the incidence of these diseases. **UK**

**>Peter Timoney, MVB, MS, PhD, FRCVS, is a professor and the Frederick Van Lennep Chair in Equine Veterinary Science at the University of Kentucky's Maxwell H. Gluck Equine Research Center.**

## Renal Disease in Horses: Common Necropsy Findings

Renal function is an important component of overall health in any species. The kidneys perform several important functions, including removing waste, maintaining electrolyte balance and blood pressure, supplying calcium for bone health, and producing factors for red blood cell stimulation, to name a few. In addition, the kidneys receive substantial blood flow—approximately 25% of the cardiac output. Therefore, changes in blood flow, either increased or decreased, can have a significant impact on renal health.

Equine necropsy cases—including fetuses, foals, and adults—submitted to the UKVLD over an eight-year period (2010-2018) were queried for diagnoses related to renal pathology.

Of the 10,541 submissions, 3.6% (386) had some type of renal pathology. Of those diagnoses, renal lesions were determined to be primary in 38% of cases (148), secondary to another process in 55% of cases (211), or incidental in 7% of cases (27).

Significant processes associated with primary lesions included:

- Inflammatory/infectious (95 cases);
- Congenital (21 cases);
- Neoplastic renal carcinoma/adenocarcinoma (10 cases);
- Nephroliths (kidney stones, 10 cases);
- Toxic (four cases);
- Trauma (one case); and
- Other miscellaneous (i.e., chronic renal failure, protein losing nephropathy, etc.) conditions (seven cases).

Within the infectious/inflammatory group, the most common cause was a bacterial pathogen resulting in nephritis. The largest proportion of cases was due to *Leptospira interrogans* infections in fetuses. Leptospirosis is a cause of abortion that often localizes to the kidney. *Actinobacillus equuli* was another common bacterial isolate, most often seen in neonatal foals and occasionally adults.

In foals, infection with *A. equuli* is colloquially termed “sleepy foal disease.” Routes of infection for *A. equuli* include a contaminated umbilicus,

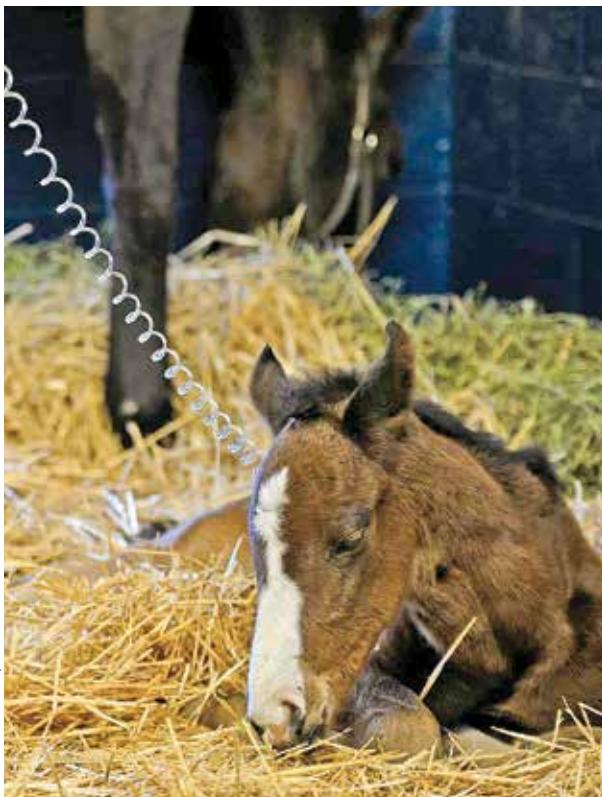
**RENAL DISEASE IN HORSES**

inhalation, or ingestion.

Several bacterial pyelonephritis— inflammation of the renal pelvis that most often results from an infection that extends up to the kidneys from the lower urinary tract (i.e., urinary bladder)—cases were identified. The most common bacterial isolates identified from cases at the UKVDL included *Streptococcus zooepidemicus*, *Escherichia coli*, and *Enterococcus* sp.

Lesions that comprised the congenital category included renal dysplasia, renal agenesis, congenital renal cysts, or congenital hydronephrosis/hydroureter. While there have been proposed associations of hereditary or nutritional components for developmental renal abnormalities in some species (i.e., dogs and pigs), in horses the pathogenesis of these congenital lesions remains to be elucidated.

Significant nephroliths were identified in 10 horses. The stones were composed of calcium carbonate or a mixture of calcium carbonate with other minerals. Typically, horses with nephroliths remain asymptomatic until the stone results in obstruction. Development of nephroliths has been associated with any nidus of renal disease including cysts, papillary necrosis,



ANNE M. EBERHARD/THE HORSE

***Actinobacillus equuli* was a common bacterial isolate, most often seen in neonatal foals and occasionally adults.**

pyelonephritis or neoplasia.

Papillary (medullary crest) necrosis due to suspected long-term non-steroidal anti-inflammatory drug (NSAID) use was identified in three of the four cases in the toxic category. NSAIDs

(i.e., phenylbutazone, or Bute, and flunixin meglumine, or Banamine) are routinely used in horses for pain management. These drugs work by inhibiting a specific group of enzymes, cyclooxygenase (COX), which subsequently reduces inflammation. Unfortunately, other downstream effects of this pathway include decreased production of prostaglandins. Specific cells located in the renal medulla produce prostaglandins that are mediators of blood flow to the tissue. Therefore, decreased prostaglandin production results in impaired blood flow to the medulla and subsequent necrosis.

Other compounding factors include dehydration and use of multiple NSAIDs. Luckily, renal complications due to NSAIDs are well-described with the result that there is judicious use of these medications in practice.

The equine kidney has a vital role in overall health. A variety of disease processes can impair renal function. Awareness of these diseases is important for equine health.

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>This is an excerpt from *Equine Disease Quarterly*, funded by underwriters at Lloyd's, London.

## Halverson Launches New Book Series to Help Fund EPM Research

Kristen Halverson's newest book, *Mac, The Butterfly Horse*, is the first in a new series that celebrates reading and nature while continuing her mission to help fund EPM research.

She continues to give back to the Gluck Equine Research Center by donating a portion of the book sale proceeds to the EPM research program headed up by Dan Howe, PhD.

In addition to donating a portion of the book proceeds to EPM research as she's done in the past, Halverson will now donate a portion of her library speaking fees to the Gluck Center.

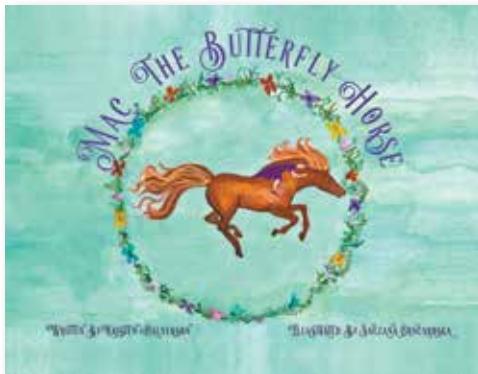
Halverson's undergraduate creative writing professor, Jeanne Larsen of Hollins

University, in Roanoke, Virginia, inspired her to write children's books. This inspiration, coupled with encouragement from her mother to share her equine and animal stories, led her to publish several children's books.

Halverson is passionate about the importance of reading and literacy and said she uses her writing skills as a core communication vehicle to raise awareness about EPM, in addition to enhancing resources for EPM research. She said she hopes her stories will inspire leaders to enhance their own efforts to advocate for EPM research resource needs.

In her newest book, released in September, the main character, Mac, is based on a horse on Halverson's farm. After losing a beloved horse, Halverson opened up her home to Mac, a senior Belgian horse, in the spring of 2018. Inspiration for the book sprung from observing Mac out in the field.

"When Mac first arrived on our farm, he was always looking around at the birds, trees, and butterflies," Halverson said. "Thus, a storyline took flight."



## HALVERSON LAUNCHES NEW BOOK SERIES

In *Mac, The Butterfly Horse*, Mac and his best friend, Marigold, find a group of beautiful butterflies near the farm's garden. Mac and Marigold then follow the butterflies to a neighboring dairy farm. Along the way, Marigold and Mac encourage each other to jump fences, creeks, and logs to get to the butterflies, leading them on a grand adventure.

The book is available for purchase on Amazon at [amazon.com/Mac-Butterfly-Horse-Kristen-Halverson/dp/1644407108/ref=sr\\_1\\_6?ie=UTF8&qid=1540238991&sr=1-6](https://www.amazon.com/Mac-Butterfly-Horse-Kristen-Halverson/dp/1644407108/ref=sr_1_6?ie=UTF8&qid=1540238991&sr=1-6). Find additional information on Halverson and her other titles at [kristenhalverson.com](http://kristenhalverson.com), [facebook.com/writingforthehorse](http://facebook.com/writingforthehorse), and [twitter.com/authorkristen1](http://twitter.com/authorkristen1). **UK**

>Samantha Geller, a senior double majoring in equine science and management and environmental and sustainability studies, is a communications intern with UK Ag Equine Programs and the Gluck Equine Research Center.

## Upcoming Events

## Dec. 18

**UK Extension Equine Summit**

**Location:** Mercer County Extension Office, Harrodsburg

## Dec. 19

**UK Extension Equine Summit**

**Location:** Daviess County Extension Office, Owensboro

## Jan. 25, 2019 – 12-5 p.m.

**UK Equine Vet CE** (formerly

Kentucky Breeders' Short Course)  
Four hours of CE credit available

**Location:** UK Veterinary Diagnostic Laboratory, Lexington

## Jan. 26, 2019 – 8 a.m.-4 p.m.

**UK Equine Showcase**

**Location:** Fayette County Extension Office, Lexington

## Jan. 28, 2019 – 5:30-8 p.m.

**Pastures Please!!**

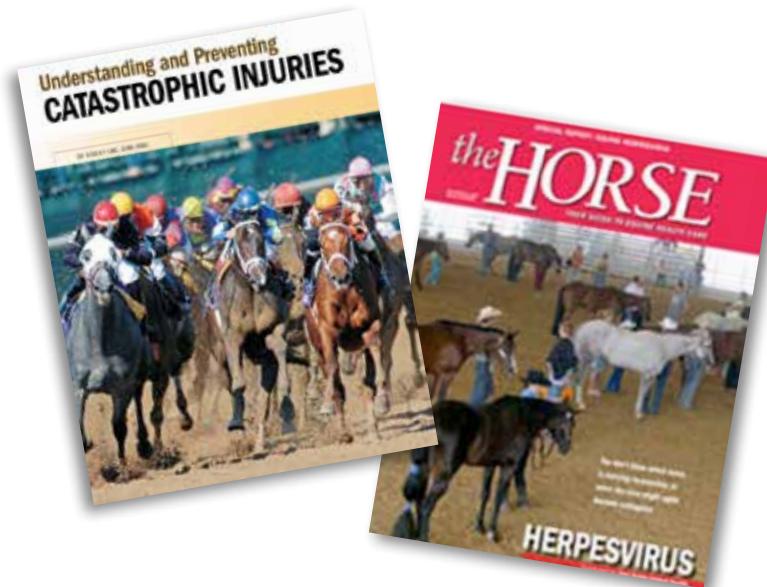
**Location:** Mercer County Extension Office, Harrodsburg

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