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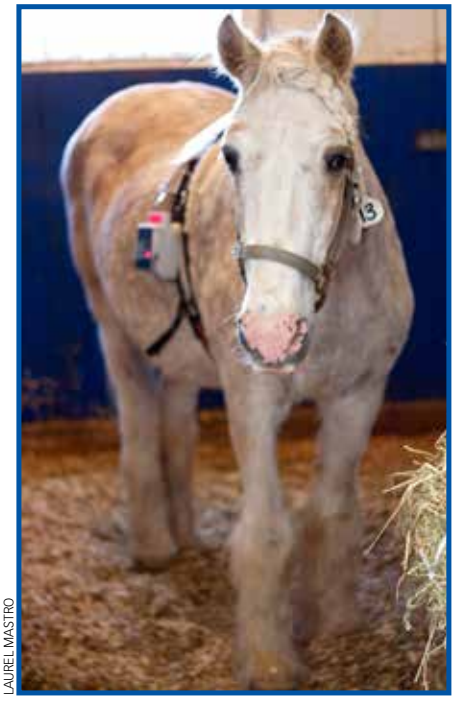
Insulin Resistance: Not Just an Old, Cushing's Horse Condition

Pituitary pars intermedia dysfunction (PPID), also known as equine Cushing's disease, is caused by a tumor formation on the pars intermedia of the pituitary gland and typically occurs in horses older than 15. Clinical signs of PPID include hirsutism, or a long, shaggy hair coat; laminitis; increased secondary infections; and insulin resistance.

PPID is commonly associated with insulin resistance, but research supporting this association is unclear. So researchers at the University of Kentucky's Department of Animal and Food Sciences recently looked further into the correlation between these two conditions.

Current and previous research has compared PPID horses to healthy younger adult horses. But because insulin sensitivity decreases with age, the results of these studies may be invalid.



LAUREL MASTRO

The researchers used EHC to quantify insulin sensitivity in the study horses.

The University of Kentucky's (UK) study might have interesting implications for feed companies as well as anyone feeding a geriatric equine. Currently, feed companies are marketing feeds formulated for insulin-resistant horses toward horses with PPID, laminitis, and/or metabolic disorders. However, the results of this study suggest that healthy normal-aged horses are just as likely to need these types of feed as the aged horse with PPID.

Overall, the study results show that insulin resistance might be a concern for all aged horses, not just horses affected by PPID. The study highlights the importance of treating each horse as an individual when it comes to assessing insulin sensitivity.

Kristine Urschel, PhD, assistant professor within UK's College of Agriculture, Food and Environment, noticed this discrepancy and decided to investigate it further.

"PPID is a problem that may affect as many as 20% of our horses over 20 years of age," she said. "For that reason, I felt it was important to look further into this disease, and I specifically wanted to look at whether these horses had lower insulin sensitivity because of PPID or simply because they were old."

Urschel contacted Amanda Adams, PhD, assistant research professor at UK's Gluck Equine Research Center. Adams has an established herd of more than 40 aged horses, several of which she suspected had PPID.

The researchers identified six horses affected by PPID based on conventional laboratory test results. Then they carefully selected six control horses (of the same age and sex as the PPID horses) that did not test positive for PPID and showed no clinical signs of PPID.

"It was very important to us that the horses were age-matched, since that was the downfall of the previous studies," Urschel explained. "Both the control and PPID horses in this study had an average age of about 25 years old."

To quantify insulin sensitivity in these horses, the team used a technique called the euglycemic hyperinsulinemic clamp (EHC). The technique works by infusing insulin at a constant rate, and then adjusting the rate of glucose infusion to maintain the horse's baseline plasma glucose concentrations. A higher rate of glucose infusion indicates a more insulin-sensitive horse, while a lower rate of glucose infusion indicates a less insulin-sensitive horse. Additionally, the researchers employed baseline plasma glucose and insulin values to calculate two proxies used to estimate insulin sensitivity and insulin secretory response in order to determine any

Articles of Interest

Insulin Resistance

differences between the two groups of horses.

The researchers found that insulin sensitivity did not differ between the PPID horses and age-matched controls. The assessment of insulin sensitivity using the EHC procedure found no difference in glucose infusion rates between the two groups during the last 30 minutes of the EHC procedure. The two proxies used to measure insulin sensitivity and insulin response also showed no differences between PPID horses and controls. The only difference the researchers found between the two groups was a trend for the PPID horses to have higher glucose concentrations during the EHC procedure.

The study results suggest that a decrease in insulin sensitivity might occur as a normal part of aging, but is not directly associated with PPID status.

"When we compared the results of this study to another one of our studies that used the exact same procedure to measure insulin sensitivity, we found that our old horses had a 75% decrease in insulin sensitivity compared to the horses around 8 years old," Urschel said.

"It seems our average aged horses may be just as much at risk for insulin resistance as our horses with PPID," she added. "PPID is a multifaceted and complex condition that needs more research to fully understand."

The study, "Pituitary pars intermedia dysfunction does not affect various measures of insulin sensitivity in old horses," was recently presented at the 2013 Equine Science Society Symposium, held in Mescalero, N.M., and was awarded 3rd place in the Production and Management category of the Graduate Student Competition. UK

>Laurel Mastro is a graduate student in the Department of Animal and Food Sciences at the University of Kentucky.

New Method for Detecting Bloodworms

Strongylus vulgaris, commonly known as the bloodworm, is considered the most pathogenic parasite infecting horses worldwide. But scientists have until now not been able to develop a reliable diagnostic method for detecting migrating *S. vulgaris* larvae.

A group of scientists from the University of Kentucky Gluck Equine Research Center and the Department of Large Animal Sciences at the University of Copenhagen in Denmark have developed a novel, reliable assay for detecting *S. vulgaris* in the bloodstream.

Martin Nielsen, DVM, PhD, Dipl. EVPC, assistant professor at the Gluck Equine Research Center, described *S. vulgaris* as the most dangerous of all equine parasites, largely due to its extensive larval migrations in the horse's arterial system. The larvae make their way to the horse's bloodstream and spend about four months there before returning to the intestine. During their migration the larvae cause a pronounced inflammation in the arterial wall and cause large blood clots to form. Smaller clots can detach and travel down larger blood vessels until they block smaller vessels. This can deprive parts of the intestinal tract from oxygen and nutrients and cause life-threatening colic.

COURTESY DR. BRIAN NIELSEN

***S. vulgaris* larvae present in a horse's artery.**

Currently, detection of *S. vulgaris* infection is based on a time-consuming larval culture with subsequent microscopic examination or a recently developed PCR detecting DNA extracted from parasite eggs. No diagnostic method has been proven useful for detecting migrating larvae of *S. vulgaris* while still in the blood, Nielsen said. The larval culture and PCR assay both detect the adult worms present in the intestine. Adult worms are not believed to cause disease, and when they are detected in a horse, serious damage in the blood vessels might have occurred months earlier.

These issues highlighted a need for reliable and improved diagnostic tools to diagnose *S. vulgaris* while still in the blood, Nielsen said.

"We used gene technology to identify potential diagnostic molecules and found one interesting antigen, which we named rSvSXP after characterizing and expressing it as a recombinant protein," he said.

The scientists extracted RNA from *S. vulgaris* worms and larvae and used this to construct an *S. vulgaris* genetic library consisting of about five million expressed genes. They identified one of these gene products to have diagnostic potential. The protein was then fully sequenced, expressed recombinantly, and validated with serum samples from 102 horses with known infection status. Additionally, they constructed an ELISA assay with sensitivity and specificity of 73.3% and 81%, respectively.

The ELISA assay has been proven capable of diagnosing the larvae while migrating in the blood vessels, so the horse can be diagnosed and treated right away before further damage occurs. Overall, Nielsen said, this is a major advancement over currently available diagnostic methods.

"Our first results are very promising, and we are hoping we can further develop diagnostic assays using this protein," Nielsen said.

He said a patent has been filed and the researchers are currently seeking financial partners in an attempt to make a test commercially available. They have gained interest from potential partners, but a diagnostic product likely will not be launched for several more years. UK

UK and Danish scientists have developed a novel, reliable assay for detecting *S. vulgaris* in the bloodstream.

>Shaila Sigsgaard is an editorial assistant for the Bluegrass Equine Digest.

Equine Muscle Metabolism

Most horse owners appreciate the sight of a well-muscled horse, along with the time and effort riders or trainers dedicate to helping that animal fill out. But chances are, fewer owners consider the factors within a horse's body that allow him to build—or lose—muscle mass.

At the 2013 Alltech Symposium, held May 19-22 in Lexington, Ky., Kristine Urschel, PhD, an assistant professor of equine science at the University of Kentucky, delivered a lecture about muscle metabolism, how equine muscle mass is regulated, and relevant research.

Skeletal Muscle

Urschel began by describing the basics of equine skeletal muscle and the pathways that regulate muscle mass. Forty to 55% of a horse's mature body weight is comprised of muscle, she explained. Muscle itself is comprised of roughly 70% water, 20% protein, and 10% fat, vitamins, and minerals, and has both structural and metabolic functions.

Muscle mass is determined by protein synthesis and breakdown, both of which occur simultaneously, Urschel said; essentially, greater protein synthesis than breakdown results in increasing muscle mass, while increased protein breakdown compared to synthesis results in decreasing muscle mass. Factors known to affect muscle mass—either positively or negatively—include age, medications, physical activity level, nutrition, illness or disease, and hormones, she said.

Next, Urschel described the signaling pathway responsible for regulating protein synthesis, commonly known as mTOR. She explained that three main factors—insulin, amino acids, and exercise—act through independant pathways to activate mTOR, thus initiating protein synthesis.

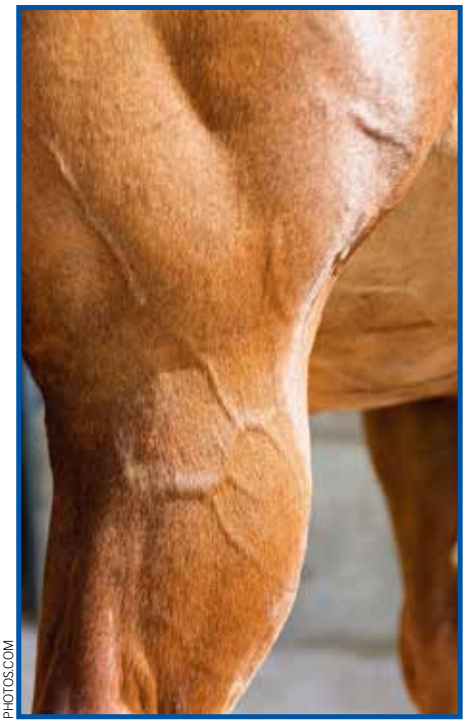
Previous Research

Limited research on protein synthesis signaling pathways has been carried out in horses. But Urschel described several related studies she's worked on during her career.

First, research she carried out with colleagues at Virginia Tech's Middleburg Agricultural Research and Extension Center showed that muscle protein synthesis increases following meals in horses, possibly due to post-feeding elevations in either amino acid or insulin concentrations, she said.

Based on the results of that study, Urschel wanted to find out more about mTOR signaling activated by insulin alone. In the following study she infused different rates of insulin, while keeping plasma glucose concentrations constant through the simultaneous infusion of a glucose solution, to see whether increased circulating insulin concentrations would result in increased mTOR signaling. While mTOR signaling did increase with increasing insulin infusion rate, the greatest changes were seen in the ranges of insulin that approximated physiological concentrations.

Urschel has also evaluated the effects of age on mTOR signaling in horses. In one study, she found that mTOR was influenced more after feeding in yearling horses compared to 2-year-olds, which she said indicates that the muscle



PHOTOS.COM

Forty to 55% of a horse's mature body weight is comprised of muscle.

MASTHEAD

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The Horse: Your Guide to Equine Health Care

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Muscle Metabolism

protein signaling pathway is more sensitive in younger growing horses and declines with age. In another study she learned that one part of the pathway—S6K1—was less active in older horses' muscle than in younger ones. Further research is needed to understand why that pathway is less responsive to stimuli, she said.

Recent Research

More recently, Urschel has investigated the effects of insulin resistance on muscle protein metabolism. In one study on the topic, she induced insulin resistance by administering the steroid dexamethsone to a population of horses. In that study she found a "profound decrease" in all muscle metabolism signaling proteins when horses received dexamethasone. From that study, she concluded that insulin resistance likely does impair muscle protein synthesis and probably reduces affected horses' ability to make and maintain muscle mass.

She also recently evaluated the effects of exercise on muscle protein synthesis. She concluded that exercise increases protein synthesis and has variable results on protein breakdown.

In another study Urschel described, researchers evaluating the synergistic effects of exercise and nutrition on muscle protein balance showed that providing amino acids and glucose to horses following exercise has a beneficial effect on rates of muscle protein synthesis and breakdown, likely resulting in a potential increase in muscle mass. Essentially, supplementing the exercising horse's diet with both amino acids and carbohydrates has a "really" positive effect on building muscle, she said.

Supplementing with amino acids and protein is also beneficial, but not to the same degree, she said.

Supplementing with carbohydrates alone is unlikely to increase muscle mass, she said, as is the case with exercise alone (with no amino acid feeding in the proximity of exercise). There has been little research in horses, she noted; however, there is ample research from human athletes that can be used as a guide for what might be expected in the equine athlete, Urschel added.

Future Research

"There are many opportunities for future research," Urschel said, such as in the field of aging horses' muscles and muscle metabolism.

One area of particular interest is the effects of exercise on a growing animal's muscle: "If growing muscle is more sensitive to feeding stimuli, will it also be more sensitive to exercise? It's a great opportunity for equine research," she said. UK

>Erica Larson is the news editor for TheHorse.com.

UK College of Agriculture, Food and Environment Name Change

On July 1, the University of Kentucky College of Agriculture became the College of Agriculture, Food and Environment. The new name better communicates the broad depth and evolving scope of the college's degrees and programs.

The change incorporates the college's expanded role that occurred nearly a decade ago with the merger of the College of Human Environmental Sciences into the College of Agriculture and also responds to new needs and opportunities. Research, teaching, and outreach programs within the college encompass farms, forests, food, fiber, families, and communities.

"While we continue our fundamental ties to production agriculture, we have expanded to include all the pervasive and essential enterprises based on renewable natural resources," said Scott Smith, dean of the College of Agriculture, Food and Environment. "We are aligned with the wider and more diverse interests of those we serve, including a new and rapidly growing population of undergraduate students. And across Kentucky, many now see agriculture to include not only farming, but also agribusinesses and the full reach of food systems from local to global."

UK UNIVERSITY OF KENTUCKY College of Agriculture, Food and Environment

Agriculture, food, and environmental systems are key components of Kentucky's economic future, and the college is playing a prominent role in those areas with its programs, Smith said.

Home to 14 academic units offering 27 academic programs, the college has more than 2,500 students, and 476 students received bachelor degrees in the 2012-13 academic year.

Since 1865, the college has been committed to improving Kentuckians' quality of life. It has carried out its federal land-grant mission, signed into law by President Abraham Lincoln, by developing cutting-edge research through its Kentucky Agricultural Experiment Station and by providing research-based information to residents in all 120 counties through local Cooperative Extension Service offices.

Each year, the Plant Disease Diagnostic Labs process more than 3,300 plant samples; the Veterinary Diagnostic Laboratory completes 60,000 cases; Regulatory Services completes 61,000 soil analyses; and more than 4 million people engage in a Cooperative Extension Service activity.

"We did not select the new name with the acronym in mind, yet we recognized that we may become known by our initials as CAFE," Smith said. "If so, we embrace many of the qualities that suggests: service, the indoor and outdoor human environment, good fare, and a community atmosphere. Perhaps CAFE will even conjure up the image of a variety of excellent selections for our employees, students, and constituents around the commonwealth—a great menu of opportunities."

The name change was approved in December 2012 by the UK Board of Trustees after first being approved by the college's faculty and staff and endorsed by the University Senate. More information about the college and the programs it offers can be found at www.ca.uky.edu or through the local extension office. A list of county office locations can be found at www.ca.uky.edu/county. UK

>Laura Skillman is the director of Agricultural Communications Services within UK's College of Agriculture, Food and Environment.

Streptococcus zooepidemicus: Only an Opportunist?

The association of a *Streptococcus* sp. with cases of equine fibrinous pneumonia was first reported in 1887 by the German bacteriologist J. W. Schultz. Now known as *S. zooepidemicus*, this organism is the most frequently isolated bacterial pathogen of the respiratory tract of weanling and yearling horses. Many of these infections are secondary to respiratory viral infections or to transportation of extended duration.

Although different genetic and serologic variants (serovars) of *S. zooepidemicus* co-colonize the tonsillar complex of most healthy horses, only a single *Streptococcal* clone is usually found in disease of the lower respiratory tract, a clone being isolates of a bacterial species that are indistinguishable in genotype. The invading clone varies from foal to foal in a group, although the same clone could affect more than one foal in that group. Genetic testing for specific genes in bacterial isolates can provide a valid, cost-effective approach to epidemiologic studies based on sequencing.

Each outbreak was associated with a different sequence type of *S. neurona*.

Most equine respiratory infections associated with *S. zooepidemicus* appear to be endogenous involving expansion of a clone similar to those in that animal's tonsillar complex. Nevertheless, outbreaks of respiratory disease involving specific clonal genotypes transmitted in a geographic area over an extended time period have been observed in recent years. Each outbreak was associated with a different sequence type of *S. zooepidemicus*, a phenomenon similar to that observed with increasing frequency in dog shelters in North America, South Korea, and the United Kingdom.

The enhanced virulence/transmissibility of epidemic *Streptococcal* clones is probably explained by genetic rearrangement or acquisitions that affect expression of virulence factors or increase their ability to proliferate and damage respiratory tissue or avoid innate immune defenses. For instance, acquisition of sequence that encodes a binding site for plasminogen in a virulence protein would create sites on the bacterial surface with plasmin-associated proteolytic activity for host cell or plasma components. Rapid proliferation accompanied by shedding of large numbers of *Streptococci* from the respiratory tract would favor onward transmission of the clone.

The extreme diversity of *S. zooepidemicus* of equine origin and evidence that it has acquired DNA by lateral horse-to-horse transfer from other streptococci suggest emergence of novel clones could be a frequent event. The mechanism and site of these transfers are unknown. However, DNA elements that can mediate genetic transfer to recipient strains of *S. agalactiae* are present in the chromosomes of some strains of *S. zooepidemicus*. Another potential mechanism involves direct uptake and exchange of DNA, an extremely efficient process between co-colonizing strains of *S. pneumoniae* in the human nasopharynx, an environment, that physically at least, closely mimics that of the equine tonsillar crypt.

Despite the diversity of equine isolates of *S. zooepidemicus*, emerging experimental evidence indicates that immune responses cross-protective for different strains can be generated. This discovery will be a significant asset in the development of effective vaccines to combat *Streptococcal* respiratory infections. UK

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WEED OF THE MONTH

Common name: **Poison Hemlock**
Scientific name: **Conicum maculatum L.**
Life Cycle: **Biennial**
Origin: **Eurasia**
Poisonous: **Yes, extremely**

Poison hemlock flowers May through July and has smooth, purple-mottled stems.

Poison hemlock is distributed widely across the United States and grows most frequently along fence borders in shady and moist areas. Seeds germinate in the fall or early spring, and plants flower May through July, depending on location. This robust growing plant can reach heights up to 10 feet. The leaves are alternate or basal (grow from the lowest part of the stem) and are three to four pinnately (featherlike) compound. The weed is sometimes confused with wild carrot (Queen Anne's lace). Stems are erect, smooth, and hollow and have purple mottling. This purple mottling is one characteristic that enables you to distinguish poison hemlock from wild carrot.

This plant is extremely poisonous to horses and humans. All plant parts contain the poisonous alkaloids; however, the fruits contain the greatest concentration of the alkaloids. Poison hemlock gives off a bad odor when crushed, and horses rarely eat this plant because of its low palatability. Poison hemlock plants harvested with hay maintain the toxic properties; care should be taken to avoid feeding hay containing this plant.

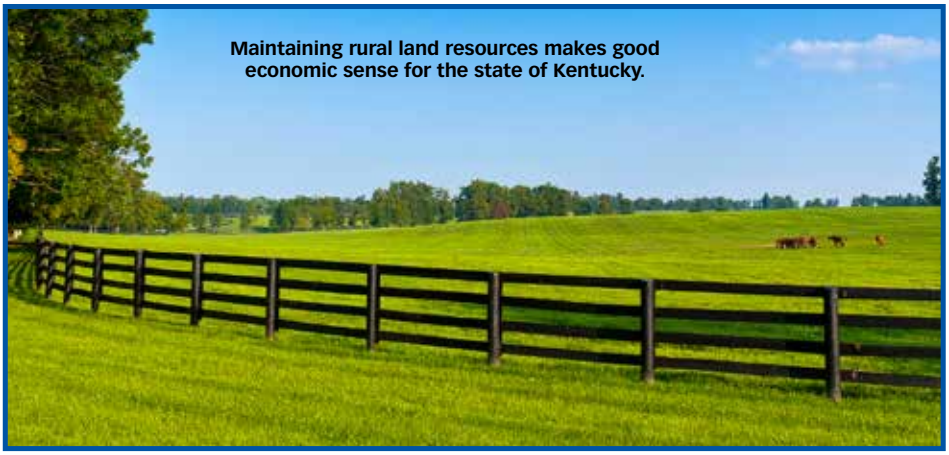
Poison hemlock is relatively easy top control with herbicides. Mowing and hand-weeding should occur well before flower production to prevent seed production. Consult your local Cooperative Extension Service personnel for herbicidal control in your area. UK

>William W. Witt, PhD, is a retired professor and researcher in the University of Kentucky College of Agriculture, Food and Environment's Plant and Soil Science Department.

Preserving Rural Landscapes

Rural dwellers have long maintained that their properties contribute livestock and other agricultural products to the region without taxing school, public safety, and other systems. Meanwhile, developers claim that their mindful building of planned housing developments not only raises land parcel prices, but also increases and diversifies a community's tax base. Lorraine Garkovich, PhD, professor of community and leadership development at the University of Kentucky, said that although agricultural land tracts are taxed at lower rates than residential properties, farms—including horse-friendly properties—play key roles in the environmental and economic health of counties and towns across Kentucky. As a result, it's key for communities to find ways to balance growth with the need to conserve land resources for rural use.

According to results of a University of Kentucky equine industry survey released in January 2013, 242,400 horses reside in the state. Kentucky is home to 35,000 equine operations, and more than 1 million of the state's rural acres are devoted to equine use. As a result, maintaining rural land resources makes good economic sense for the state.



Maintaining rural land resources makes good economic sense for the state of Kentucky.

PHOTOS.COM

But maintaining the state's rural integrity is not easy. Garkovich said there are several key rural land conservation issues facing property owners and county and local governments in Kentucky and elsewhere. She said chief among those issues are protecting soil resources, sustaining and enhancing farming—including horse farming—as a key component of state and local economies, protecting groundwater recharge areas, maintaining scenic open spaces, and minimizing state, county, and local land use conflicts.

Garkovich said soil preservation is critical as well. Soils found in many parts of the state are highly productive for agricultural purposes. But once that resource is gone, she said, it's gone.

"Once developed by residential, commercial, or industrial uses, this productive resource is lost to agriculture forever," Garkovich.

Likewise, the preservation of groundwater recharge areas is crucial, especially to those who raise livestock, Garkovich said. Many Kentucky families as well as public water systems depend on groundwater as their major source of drinking water, she said. But many rural homes rely on septic systems to contain waste water and those systems can fail. As a result, continued development using septic systems can threaten groundwater resources.

"Therefore, protecting areas that are critical in replenishing the groundwater source is important," Garkovich said.

Finally, Garkovich said it is important to maintain scenic open spaces around the state. These so-called "green spaces" not only enhance nearby residential properties' value, but they also contribute to Kentucky's tourism appeal.

Maintaining Kentucky's rural resources require both private and public will. Communities might adopt zoning ordinances designed to define land use

Rural Landscapes

to preserve rural resources while accommodating growth derived from land development.

"Zoning ordinances may also define how development occurs within a particular zone by, for example (defining) subdivision development standards," Garkovich said.

Communities can also adopt so-called "right to farm" ordinances. These measures make agriculture a priority so long as farmers meet best practices standards in cases of "nuisance" complaints by adjacent nonfarm property owners.

"The purpose of such ordinances is to reduce the loss of agricultural resources by clarifying the circumstances under which agricultural operations may be considered a nuisance, and to promote a good neighbor policy," Garkovich said.

Finally, Garkovich said, farmers can contribute to rural resource preservation by working with qualified conservation organizations to restrict or prevent land development for non-rural purposes.

"In this case, the farmland owner agrees to permit the qualified conservation organization to acquire an 'interest' in their land so that non-farm development does not occur on the land," Garkovich said. "This interest may be acquired through a sale, a grant, or by other means."

Garkovich said when it comes to preserving rural resources communities and individual land owners have many options. Which option they choose can be in the state and community's long-term best interest. UK

>Pat Raia is a professional journalist who covers horse industry and equestrian topics.

Sri Lanka's Ambassador Visits UK, Gluck Center

As our world becomes increasingly interconnected via technology, opportunities for universities to collaborate across the globe also increase.

On Friday, July 12, the University of Kentucky (UK) hosted a visit by the Sri Lankan ambassador to the United States, Jaliya Wickramasuriya, and his wife, Priyanga Wickramasuriya, to explore the development of academic affiliations between UK and one or more universities in Sri Lanka, an island country of just over 20 million people located in the northern Indian Ocean, near India.

MATT BARTON PHOTOS

Ambassador Wickramasuriya and his wife visited UK to explore academic partnership

Ambassador Wickramasuriya and UK officials discussed proposals for joint cancer research projects between UK and the University of Peradeniya and the National Cancer Institute of Sri Lanka and, potentially, opportunities for mutually beneficial education and training programs in the two countries. The partnership might later be extended to include infectious diseases and equine management or other disciplines related to agriculture and equine science.

The proposed affiliation between institutions in the two countries was initiated at the request of Frederick de Beer, MD, dean of the UK College of Medicine, with the goal of expanding UK's international outreach program to developing countries in Asia. He requested that Marcus E. Randall, MD, FACR, FASTRO, professor and Markey Foundation Endowed Chair in Radiation Medicine in the UK College of Medicine, and Udeni Balasuriya, BVSc, MS, PhD, professor of virology at the Gluck Equine Research Center in UK's Department of Veterinary Science in the UK College of Agriculture, Food and Environment, establish a link with academic and research institutions in Sri Lanka. Both are scheduled to visit Sri Lanka in August, when they will meet with collaborators and discuss research projects involving UK.

During the visit, the ambassador also stopped by the Gluck Equine Research Center for a tour and to meet with Balasuriya and Mats Troedsson, DVM, PhD, Dipl. ACT, director of the Gluck Center and chair of the department of veterinary science at UK. Following the tour, Balasuriya, a native of Sri Lanka, hosted a dinner at his home. UK

More information about the visit is available at: http://uknow.uky.edu/content/sri-lankas-ambassador-explores-affiliations-uk.

EPM Diagnostics

Antemortem (before death) diagnosis of equine protozoal myeloencephalitis (EPM) has been a long-standing source of frustration for equine veterinarians and horse owners. Typically, a diagnosis of EPM has been based on the presence of clinical signs consistent with neurologic disease along with a supportive serologic test demonstrating the presence of antibodies against the primary etiologic agent. Most often this is the protozoan parasite *Sarcocystis neurona*, although EPM is attributed infrequently to the related parasite *Neospora hughesi*.

Unfortunately, most any neurologic disease can cause clinical signs similar to those associated with EPM. Moreover, horses are frequently exposed to *S. neurona*, so simply the presence of antibodies in the blood has little diagnostic value. Given these challenges, it is little wonder that some veterinary practitioners have relied on "response to treatment" as a primary diagnostic criterion. This approach to EPM diagnosis is not only expensive; it can be misleading as well.

Thankfully, it is now possible to view EPM diagnosis with much greater confidence. The development of semi-quantitative assays that can measure antibodies against *S. neurona* allow for diagnostic methodology that iden-

EPM Diagnostics

tifies with high accuracy horses suffering from EPM. Specifically, the assays can be used to demonstrate *S. neurona*-specific intrathecal antibody production (i.e., antibodies produced in the central nervous system), which indicates that there is active infection. This approach has been used for decades in human medicine and is based on comparing the amount of antigen-specific antibody present in the cerebrospinal fluid (CSF) relative to the blood. Infection in the central nervous system is confirmed when the amount of antibody present in the CSF is greater than anticipated from normal passive transfer across the blood-brain barrier.

In summary, obtaining an accurate antemortem diagnosis of EPM is no longer an exercise in frustration.

A recent multi-investigator collaboration examined 128 horses that were diagnosed by postmortem examination with either EPM or another neurologic disorder (e.g., cervical-vertebral malformation). Serum and cerebrospinal fluid (CSF) from each horse were tested with two enzyme-linked immunosorbent assays (ELISAs) that detect antibodies against the conserved *S. neurona* proteins SnSAG2, SnSAG3, and SnSAG4. Three major conclusions were derived from the results of these analyses:

- The ratio of antibody in serum vs. CSF provides an accurate diagnosis of EPM (about 92% sensitivity and 83% specificity).
- Although less accurate for diagnosis, higher antibody titers in CSF were associated with EPM.
- Serum antibody titers alone were not a good indicator of EPM.

Collectively, the findings from the study confirmed that intrathecal antibody production against *S. neurona* is a valuable criterion for EPM diagnosis, and they highlight the importance of performing spinal taps on suspected EPM cases to allow measurement of antibody in CSF.

The SnSAG2 and SnSAG4/3 ELISAs used for this study are capable of providing an accurate measurement of antibodies against *S. neurona*, which is critical for showing definitively that there are disproportionate amounts of antibody in the CSF. However, it should be noted that these ELISAs have no magical attributes that make the procedure exclusive to them. Consequently, it should be possible to obtain similar results using other reliable tests that can quantify anti-*S. neurona* antibodies (e.g., the immunofluorescent antibody test).

UPCOMING EVENTS

August 22

Department of Veterinary Science Equine Diagnostic Research Seminar Series, 4 p.m., University of Kentucky Veterinary Diagnostic Laboratory, Respiratory Endoscopy, Gary Priest, DVM, Harthill and Priest Equine Surgery

In summary, obtaining an accurate antemortem diagnosis of EPM is no longer an exercise in frustration. While it is still important to conduct a careful neurologic examination of a suspect EPM case, the ability to assess the *S. neurona* neuroinfection status using a supportive test has improved tremendously, thus leading to much greater confidence in a diagnosis. In turn, this leads to better and more timely care for horses suffering from neurologic disease. UK

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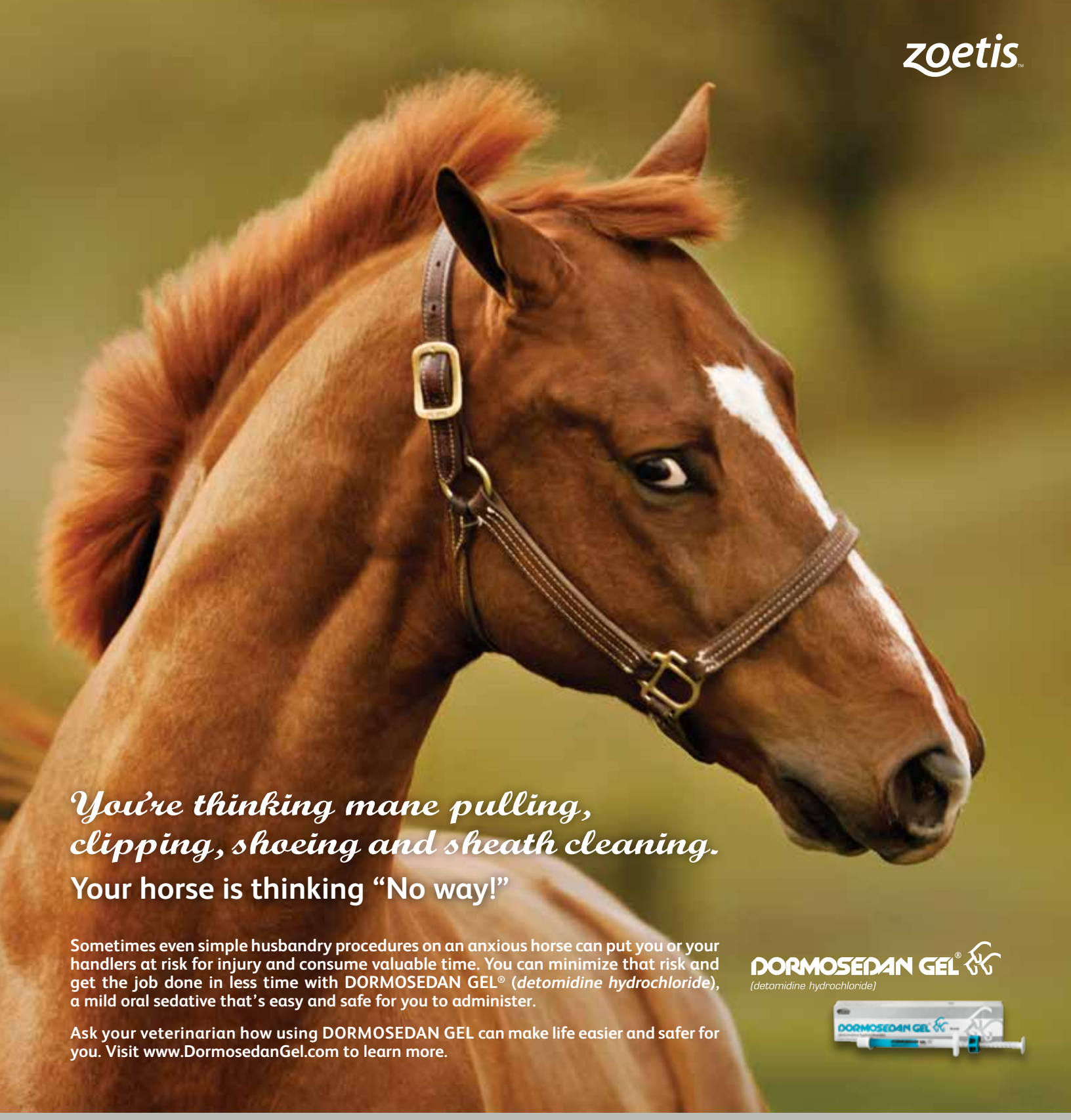

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