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## Gluck Center Researchers Study Inflammatory Markers in Endurance Horses



DR. ALLEN PAGE

Researchers had the opportunity to study inflammatory biomarkers in nonracehorses for the first time at the 2018 Tevis Cup endurance ride.

Much of the research conducted by scientists at the University of Kentucky (UK) Gluck Equine Research Center, in Lexington, takes place in and around Central Kentucky—after all, it’s been dubbed the “Horse Capital of the World.” But sometimes researchers get to take the show on the road.

Earlier this year, Allen Page, DVM, PhD, researcher and veterinarian at the Gluck Center, who works with David Horohov, PhD, director of the Gluck Center and chair of the UK Department of Veterinary Science, traveled to the one-day 100-mile Tevis Cup endurance ride, which takes place annually in Northern California, for a research project.

Since 2012, Page, Horohov, and colleagues have been studying inflammation in racehorses and the utility of inflammatory marker testing to quantify fitness and possibly detect brewing injuries before they become more serious. Inflammatory marker testing measures multiple genes responsible for horses’ inflammatory responses. As

the Thoroughbred industry works to improve racehorse safety and welfare, Horohov and Page saw the potential for this research to significantly impact horses in other disciplines, as well.

“While we have focused most of our efforts on the effect of exercise on inflammatory responses in Thoroughbreds, we recognize that similar effects are likely to occur in other equine athletes,” Horohov said.

At the top of their wish list of disciplines to work with was endurance, due to the sport’s unique demands.

The Tevis Cup provided the opportunity they were seeking, although it almost did not happen this year. Each year, Tevis Cup organizers offer one research group the opportunity to conduct studies during the event. A different group was scheduled to attend but had to withdraw, providing an opportunity the Gluck researchers were thrilled to seize, even on short notice.

“We really lucked out to get the chance this year, as the Tevis Cup was a great first opportunity to measure inflammatory markers in nonracehorses,” Page said. “We went into this study having no idea of what kind of participation we would have or what we would see with the results.”

Conducting research on the other side of the country involved significant planning and preparation well in advance of the event. This included predicting study

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**GLUCK RESEARCHERS ATTEND TEVIS**

participation, ordering and shipping supplies, and coordinating with three local research assistants to help collect blood samples during the event.

“Having seen the Tevis Cup firsthand as a veterinary student at the University of California, Davis, I thought I knew what I would be in for with this study,” Page said. “But once the horses started coming into the sampling checkpoints, it was obvious I had underestimated the scope of what we were trying to accomplish.”

The ride, which starts near Lake Tahoe and finishes outside Sacramento, has no central location at which to collect samples, so the team had to relocate several times as the ride progressed.

“Thankfully, I had three excellent technicians and the full support of the ride organizers to help us accomplish all of our goals,” Page said.

When Page left for California a few days before the ride, he was nervous.

“Getting on the flight, we only had 10 riders signed up to participate, and we were definitely going to need more to help with our data analysis,” he said. “Based on previous studies, the ride organizers thought we would get 50% participation, but honestly, I was going to be thrilled to get 40 to 50 riders.”

In the end, 80 of the 150 riders participated. Page attributes many of those to the ride organizers, who encouraged participation by giving away a limited-edition trail map poster to riders who took part in the study. It was another example of

an equine industry coming together to help support research ultimately geared toward improving their sport, and Page said he was glad to play a role.

“The ride is always a grueling test for each horse and rider pair, but this year was made more difficult by hot temperatures and poor air quality,” he said. “Having now witnessed firsthand this incredible test of endurance, I realize, more than ever, how lucky I am to have been able to work with these amazing athletes. The determination of the horses and the incredible care they get from the riders, crews, and veterinarians cannot be overstated and is impossible to describe.”

While their studies in Thoroughbreds will continue, Horohov and Page see their Tevis Cup research as the first of many projects looking at inflammation in nonracing equine athletes. The group has recently started studying high-level eventing horses and is already seeing promising results. They hope to expand this work into other disciplines while continuing to build upon the foundation the Tevis Cup information will provide their endurance horse work.

“While I continue to work on wrapping my head around the incredible opportunity I was given by the ride organizers and study participants, I can’t wait to analyze the results of our work to see what we can do to help out these horses and riders in the future,” Page said. **UK**

>Jenny Evans, MFA, PhD candidate, is the former senior veterinary science marketing and promotion specialist at the UK Gluck Equine Research Center.

**Masthead**

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**The Horse: Your Guide To Equine Health Care**

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**How Endophyte-Infected Tall Fescue Impacts Broodmare Blood Flow**

Researchers know some types of tall fescue—particularly, those playing host to toxic endophytes called ergot alkaloids—can be bad news for pregnant mares. They know that mares consuming endophyte-infected tall fescue can develop fescue toxicosis, characterized by a lack of milk production, prolonged gestation, placental thickening, and weak or nonviable foals. They even know that ergovaline—a type of ergot alkaloid—can cause vasoconstriction (blood vessel constriction) in horses.

What they don’t know is exactly how the ergot alkaloids cause the problems seen in pregnant mares. One theory is that decreased blood flow to the uterus plays a role. Researchers previously determined that feeding horses ground endophyte-infected tall fescue results in vasoconstriction in the distal palmar artery (located in the horse’s lower limb), and such decreased blood flow to the uterus could have an impact.

So, researchers from the USDA Agricultural Research Service’s Forage-Animal Production Research Unit (ARS-FAPRU) and the UK Gluck Equine Research Center set out to evaluate whether a lack of placental blood flow could contribute to fescue toxicosis

## ENDOPHYTE-INFECTED TALL FESCUE

development. Specifically, they evaluated how ergopeptine alkaloids (ergovaline, ergocryptine, ergocristine, ergocornine, and ergotamine) and ergoline alkaloids (lysergic acid and ergonovine), two ergot alkaloids found in endophyte-infected tall fescue, impact vasoactivity in the equine palmar artery and vein and uterine artery.

James Klotz, PhD, a scientist at ARS-FAPRU, and Karen McDowell, PhD, EMB, an associate professor at the Gluck Center, harvested palmar artery and vein segments of 23 cadaver horses' forelimbs, as well as uterine arteries from 12 cadaver mares. They sliced the arteries and veins into cross-sections and incubated them in a buffer for 90 minutes. Then, to assess how the veins and arteries respond to the alkaloids, they applied:

- Increasing concentrations of ergovaline, ergocryptine, ergocristine, ergocornine, and lysergic acid to the palmar samples; and
- Increasing concentrations of norepinephrine, serotonin, ergotamine, and ergonovine to the palmar and uterine samples.

Prior to the alkaloid exposure, the team confirmed the presence of adrenergic receptors (adrenaline) and serotonergic receptors (serotonin) in each palmar artery and vein sample by adding increasing amounts of norepinephrine and



KEVIN THOMPSON/THE HORSE

**Study findings suggest that other factors beyond maternal vasoconstriction are likely involved in tall fescue's effects on the equine fetus.**

serotonin. Klotz said they included this step because ergot alkaloids can interact with these receptors, causing blood vessel contraction. Because norepinephrine caused the most significant contraction of the two, they used that as a standard to compare the alkaloids' effects.

Key study findings included:

- Ergonovine and ergotamine induced a moderate contractile response in both palmar samples, approximately 40% and 20% of the maximum contraction norepinephrine caused, respectively;
- Ergovaline produced the earliest contractile response in palmar vessels compared to the other four ergopeptine alkaloids tested, followed by ergotamine, while ergocristine produced the smallest contractile responses; and

- Lysergic acid did not produce any vasoactivity in palmar samples.

The team found less pronounced contractile responses in the uterine artery after alkaloid exposure. The artery showed a significant contractile response when exposed to high norepinephrine concentrations, but none with serotonin, ergonovine, or ergotamine exposure.

"We were surprised by the lack of ergot alkaloid vasoactivity in the uterine artery preparations based on the traditional effects seen in pregnant mares," said Klotz.

However, these findings agree with others from McDowell's research group, which suggest that pregnant mares' uterine arteries are less responsive to the endophyte-infected fescue seed's vasoconstrictive effects than the palmar arteries.

"In light of this, we believe determining sites of ergot alkaloid vascular activity to be a step toward understanding how alkaloids cause decreased performance in equine production systems," Klotz said.

These findings suggest that other factors beyond maternal vasoconstriction are likely involved in tall fescue's effects on the equine fetus.

The study, "Tall fescue ergot alkaloids are vasoactive in equine vasculature," was published in the *Journal of Animal Science*. **UK**

>Kristen M. Janicki, MS, PAS, is an equine nutritionist and freelance writer for *The Horse*.

## Utilizing Cost-Share Programs on Horse Farms

*Author's Note: This article focuses on programs in Kentucky, but similar programs are available in many other states.*

Horse-keeping costs extend far beyond the basics of feed, hay, and routine farrier work and veterinary care. Horse owners and farm operators might overlook, but could eventually be faced with, larger projects, such as making pasture improvements, building hay storage facilities, installing high-traffic pads, and constructing safe stream crossings. The good news is that cost-share programs offer horse owners a chance to improve infrastructure at a reduced price tag.

As the name suggests, these programs



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**Adding interior fencing to divide large pastures into smaller paddocks to promote better rotational grazing on horse operations is a popular EQIP-eligible practice.**

are designed to share the cost of improvements with the farm owner. Programs can cover 50% to 90% of the actual costs, allowing horse owners to invest in farm improvements that might

otherwise be out of their budget. Cost-share programs' goals vary, but generally focus on one of two areas: environmental protection and farm productivity.

### Environmental Protection

A leading environmental protection cost-share program is the Environmental Quality Incentive Program (EQIP), which is administered by the USDA Natural Resource Conservation Service (NRCS). This program has both financial and technical environmental benefits on working agricultural lands. Goals include reducing agricultural production's impacts and protecting the operation's long-term economic stability.

Adding interior fencing to promote better rotational grazing on horse operations is a popular EQIP-eligible practice. Large pastures divided into smaller paddocks allow farm operators to implement rotational grazing, which can help promote

**COST-SHARING PROGRAMS**

grass and legume ground cover, reduce runoff and soil erosion, and curtail the need to purchase hay.

Constructing stream crossings is another eligible practice. Streambed traffic, from livestock or vehicles, can erode banks, causing flow changes and affecting wildlife living in or near the stream. Additionally, stream crossings can be dangerous for livestock if they slip and fall in muddy footing or on hidden rocks. Water quality can also be impaired if livestock have open access to streams. Improved crossings usually aim to stabilize the stream banks, provide safe footing for animals or vehicles to cross, and restrict stream access.

Funds from NRCS-EQIP are available

to all commodities and livestock farms and recently became available to small horse operations. In Kentucky, there is no minimum acreage requirement for participation. Interested applicants should visit their local NRCS office to become more familiar with what EQIP offers and the requirements for participating in the program. Find EQIP application information by state at [nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/eqip/?cid=nrcs143\\_008223](http://nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/eqip/?cid=nrcs143_008223).

**Farm Productivity**

The County Agricultural Investment Program (CAIP) is a cost-share program available through the Kentucky Agricultural Development Fund and the Kentucky Governor’s Office of Agricultural Policy. The program aims to increase net farm income, add value to products, and

diversify operations, all of which can make a farm more profitable and more likely to stay in agricultural production.

Eligible CAIP investments can include commodity (including hay) storage. Dry hay storage on horse farms can significantly reduce waste, therefore lowering the annual hay expense, and dry hay also retains better quality and is more likely to meet horses’ needs to reduce the requirement for additional concentrates.

Other investment areas could include improving pasture productivity with seed, fertilizer, or herbicide applications, as well as fencing improvements or construction of run-in sheds and equipment storage buildings. Check with your local county extension agent about the availability and eligibility of CAIP or other local cost-share programs.

**How are Cost-Share Programs Administered?**

While every program is different, they share some key elements:

- Due to high program demands, there is often a limited application window. The Kentucky CAIP program generally has a 30-day window to apply, typically in late summer, but timing varies by county. EQIP applications are accepted year-round and are batched periodically throughout the fiscal year. Applications received by each batching period are ranked and funded based on funding availability. Batching periods are announced via local media outlets as well as on the Kentucky NRCS webpage 30 days prior to the end of the batching period. For fiscal year 2019, Kentucky has announced a batching period cutoff on Nov. 2 for certain EQIP Fund accounts. Interested applicants should visit their local NRCS office or the Kentucky NRCS webpage at [nrcs.usda.gov/wps/portal/nrcs/main/ky/programs/financial/eqip](http://nrcs.usda.gov/wps/portal/nrcs/main/ky/programs/financial/eqip) prior to Nov. 2 to find out which fund accounts will be included in this first batching period. Additional fiscal year 2019 batching periods will be announced as deadlines approach.
- Time of practice/investment is also limited. EQIP will not cover any practice that has already begun before the final contract is signed but can cover projects up to three years out. CAIP will often go up to six months retroactive but only covers future projects that will be completed within the next six months. Project deadline timing can vary by county.

**GRAD STUDENT SPOTLIGHT**

**SHAVAHN LOUX**

**From: Davis, California**

**Degrees and institutions where received:**

**BS, animal science, Cal Poly, San Luis Obispo**

**PhD, biomedical sciences, Texas A&M University**



Shavahn Loux, PhD, chose to come to UK for her postdoctoral studies because of her passion for horses. She said it was the ideal place to continue her academic journey.

“UK has arguably the best equine research program in the country, with world-renowned researchers collaborating to improve equine welfare,” she said.

Loux is working under the direction of Barry Ball, DVM, PhD, Dipl. ACT, Albert G. Clay Endowed Chair in Equine Reproduction at UK’s Gluck Equine Research Center, and has been involved in a wide range of equine reproduction projects, particularly focusing on monitoring gestational health using bioinformatic tools.

One of her major projects has involved describing how messenger RNAs and microRNAs change through normal pregnancy and during placental disease, particularly placentitis. Along these same lines, Loux has identified the major proteins present in both amniotic and allantoic fluid during normal pregnancy and placentitis.

Ideally, she said, these studies will provide information to better diagnose and treat gestational abnormalities. In addition, Loux has been working to better describe the equine cervical mucus plug, a crucial structure produced by the cervix in late gestation that has both antimicrobial and anti-inflammatory properties.

When asked what her most valuable takeaway was from the program, Loux said, “I have learned a tremendous amount in my time at the University of Kentucky, and it’s hard to say any one thing is the most valuable.

“I think the bioinformatics skill set I’ve gained is high on that list, as are the collaborations I’ve formed with scientists within the program.” she said. “It’s nice to know that you only have to go down the hall to talk to a leading equine immunologist or parasitologist.”

Loux is currently looking for an academic faculty position. **UK**

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

**COST-SHARING PROGRAMS**



ALEXANDRA BECKETT/THE HORSE

**Farm productivity investment areas could include improving pasture productivity, making fencing improvements, or even installing automatic waterers.**

- Any practice or investment must meet the program goals and serve the producer. To ensure investments are beneficial in meeting program goals, horse owners might be required to complete a water quality plan, have a grazing plan on file, and attend educational events.
- Projects must meet conservation practice standards. Payment is often not issued until a practice is professionally certified to meeting standards. Practices must also be maintained for a minimum amount of time or lifespan. Pasture improvements are shorter, often just five years, while infrastructure is longer, such as 20 years for fencing and 15 years for automatic waterers. Additionally, the responsibility of maintaining these investments go with the land. So, if a property is sold soon after completing these improvements, the new owner accepts the responsibility of maintaining the investments.

**Where Do I Sign Up?**

Most programs are limited to specific areas, so no universal sign-up exists. EQIP is a national program that is available in all 50 states and Puerto Rico while CAIP is specific to Kentucky, though similar programs exist in other states. Most agricultural cost-share programs will in some way involve either the local Cooperative Extension office (state) or the local NRCS District office (federal). Both of these agencies can provide a wealth of technical information to all types of producers and work with horse owners to be aware of cost-share opportunities and assist in

the application process. If you are interested in learning more about cost-share programs available in your state or local area, contact your county agent and natural resource manager.

**How UK Is Involved in Cost-Sharing**

The NRCS Regional Conservation Partnership Programs (RCPP) represent another area of cost-share funding. These programs are often part of a larger program, such as EQIP, but are administered by a localized group for a more specific clientele. In 2016, the UK Department of Plant and Soil Sciences was awarded a RCPP agreement to serve horse owners in Kentucky. "Overgrazing and Soil Degradation on Horse Farms in Kentucky" is a first-of-its-kind program exclusively covering equine operations. This program has the same goals as EQIP and operates in much the same way, except that funding is set aside specifically for this program. In 2017, three horse farms were nominated by their local Cooperative Extension agent or natural resource manager and selected to serve as demonstration farms.

The first of these farms was Paul and Melita Knapper's Mercer County breeding operation. The Knappers had sufficient land for their horses, but much of it was in row-crop production, meaning their cool-season pastures were being overgrazed. Through the NRCS-RCPP program, the Knappers have fenced three additional pastures, established cool-season grasses, and installed automatic waterers. Increasing the number of grazing acres allows them to rotationally graze their

pastures. In 2018, the Knappers hosted the UK Equine Farm & Facilities Expo to showcase their improvements.

Other demonstration farms include Weber's Retired Horses, in Princeton, and the YMCA Camp Ernst stable, in Burlington. These farms have installed stream crossings, a pond, heavy-use areas, automatic waterers, and established pastures as part of their contracts. Each will be hosting an educational event in the next two years.

In addition to these three demonstration farms, 10 other farms in Bourbon, Campbell, Clark, Henderson, Knott, Mason, Union, and Woodford counties are participating in the program.

Funds allocated to these 13 farms total nearly \$200,000 and improvements cover more than 500 acres of horse pasture and adjoining natural resources.

This program would not be possible without help from industry partners, including Bluegrass Equine Digest, Grayson Jockey Club Research Foundation, Kentucky Forage and Grassland Council, Kentucky Quarter Horse Association, Mars Horse Care, McCauley Brothers, Pennington Seed, Thoroughbred Owners and Breeders Association, and Woodford Feed Co. **UK**

>Krista Lea, MS, research analyst and coordinator of UK's Horse Pasture Evaluation Program; Ray Smith, PhD, professor and forage extension specialist, both within UK's Department of Plant and Soil Sciences; and Linda McClanahan, Mercer County Extension Agent for Agriculture & Natural Resources, provided this information.

**Researchers Define Genomics Applications in the Horse Industry**

Horse genomics experts from around the world have issued a statement regarding the application of genomics in the equine industries.

The statement outlines the values of scientists working in the broad area of horse genomics.

The statement was discussed and drafted at a recent Horse Genome Workshop meeting, which took place Sept. 12-15 in Pavia, Italy. This meeting was the latest in a series beginning in 1995 with the goal of fostering collaboration among scientists to create and use genomic tools for the benefit of the horse and the horse industry. Scientists have met regularly under the auspices of the Dorothy Russell Havemeyer Foundation, the International Society for Animal Genetics, and the USDA NRSP8 program. They have also participated in workshops leading to mapping the horse genome, development of the whole genome sequence for the horse, and development of tools for studies of gene expression in different tissues.

Since the beginning of the workshop, scientists have used the information to identify



**GENOMICS APPLICATIONS**

genes responsible for many simple hereditary traits and have developed prediction models for more complex traits. Breakthroughs arising from these research efforts are also revealing the fine details of the biochemical and cellular pathways that underpin performance, immunology, reproduction, and infectious disease response and could ultimately lead to novel management approaches.

“When these efforts began over 20 years ago, one of our challenges was to foster trust and collaboration among participants,” said Ernest Bailey, PhD, professor of genetics and genomics at the UK Gluck Equine Research Center. “In light of our successes, this statement underlines our commitment to work in concert with all elements of the horse industry to ensure

health and success for their endeavors.”

The equine genomics research community said it recognizes there are challenges facing the translation of the outcomes from the Horse Genome Project into practice. Therefore, the scientists discussed and agreed on the best approach to the application of their research.

- They agreed that:
- Scientific discovery should be reproducible and subject to the peer-review process;
  - Scientific research projects must conform to best practice in relation to owners’ consent for sample use and research ethics;
  - Industry stakeholders must be provided with educational opportunities so scientific developments can be communicated for translation into practice in the ways that will have the greatest potential to benefit horses;
  - Clear differentiation must be made

- between scientific developments, commercial opportunity, and opinion;
- Some genetic tests can be diagnostic for the presence or absence of a trait while others can be used as a screening and selection tool for prediction of potential to develop a trait; and
  - The integration of genetic information with traditional breeding approaches will be important for the sustainability of a healthy horse population in the future.

The statement also reiterated that the genomics research community continues to welcome collaboration and cooperation with the equine industries.

The complete *Consensus Statement on the Translation and Application of Genomics in the Equine Industries* is available at [horsegenomeworkshop.com/values](http://horsegenomeworkshop.com/values). **UK**

>Edited press release from the Horse Genome Workshop.

## Parasite Control for Boarded Horses

**Q** What’s the best way to go about making the decision to deworm if my horse is boarded at a large facility? For instance, historically my horse has tested as a low to no shedder, and he only goes out with two other horses. Should we have the recommended three fecal tests this year and then decide? Are there other considerations to keep in mind?

Let’s say all three horses test as low to no shedders, and the recommendation is not to deworm. Any suggestions for effecting change at a farm that follows tradition (i.e., generally they deworm all the horses without fecal egg counts)?

—Louise, via e-mail

**A** Thank you for your question, which is very relevant as lots of people are in a very similar situation.

The best approach is always to coordinate efforts at the facility so all horses are included in an overall parasite control program. This does not mean all horses are necessarily treated with the same products at the same time, but it’s important to avoid the patchwork-type programs where one person doesn’t know what the next one is doing when and why. Parasite control is about controlling the parasite population present in a given equine operation.

The parasite population is shared between all the horses present on a farm, but that doesn’t mean all horses have identical deworming needs. A constant low-shedding adult horse in good health doesn’t need more than one or two treatments within a year—often to be considered in the spring and fall.

In addition to strongyles, it’s important to consider tapeworms, which are likely to be present on a majority of farms. Horses in the high-shedding category (typically above 500 strongyle eggs per gram) could need one or two additional treatments to ensure



The parasite population is shared between all the horses present on a farm, but that doesn’t mean all horses have identical deworming needs.

that contamination of paddocks and pastures is reduced. Then, you can collect follow-up samples to check the efficacy of each treatment to ensure that everything worked as intended. The latter is of extreme importance, because many horse owners are wasting their money on products that don’t work anyway (due to parasites’ anthelmintic resistance).

Spending a little money on fecal egg counts is a good investment in your horse’s health and well-being rather than conducting blindfolded chemical warfare.

As mentioned above, a surveillance-based parasite control principle should really be applied to the entire boarding facility. This is a management decision, of course, but I know of many examples where parasite control is part of the monthly boarding fee and is coordinated by one veterinary practice. That’s the way forward. **UK**

>Martin Nielsen, DVM, PhD, Dipl. ACVM, is an associate professor and Schlaikjer Professor of Equine Infectious Disease, at the UK Gluck Equine Research Center.

## Mineral of the Month: Phosphorus

It is only appropriate to follow last month's column on calcium (Ca) with its sidekick, phosphorus (P). Phosphorus is the second-most abundant mineral in the horse's body; about 80% of it is found in horses' teeth and skeleton.

Calcium and phosphorus are very closely linked, because Ca combines with P to form hydroxylapatite, found in bone and teeth. A dietary deficiency or excess of either one can interfere with the other's absorption and utilization. As such, when evaluating a diet, ensuring that the P and Ca requirements are met is important, but making sure the horse is consuming an appropriate ratio of Ca to P in the total diet is paramount.

Your horse's total dietary Ca:P ratio should not drop below 1.1:1 (National Research Council's *Nutrients Requirements of Horses*, 2007; NRC). Typically, unfortified grains (e.g., oats or corn) naturally



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**If you live in an area geographically rich in phosphorus (such as in Central Kentucky), your horse will likely consume more P than he or she needs, even from forage grown there alone.**

contain more P than Ca. Additionally, if you live in an area geographically rich in P (such as Central Kentucky), forages also tend to contain higher amounts of P. In some cases, a grass forage's P content can even exceed the Ca content. In cases where the Ca:P ratio drops below 1.1:1, additional Ca will be needed in the diet to improve the total dietary Ca to P ratio. You can accomplish this by adding legumes or Ca-fortified concentrates.

The NRC recommends 14 grams of P (and 20 grams of Ca) per day for a mature, idle horse that weighs about 1,100 pounds (500 kilograms). If you live in a high-P area, your horse will likely be consuming more P than he needs, even from forage alone. The horse's body will absorb all the P it needs from the digested feed in the hindgut and excrete the excess in manure.

It's important to note that excessive P in manure is also concerning, due to its impact on water quality. Pastures with poor manure management practices in place (or even poorly managed manure storage facilities) that are located near water bodies can result in nutrient runoff into waterways. The water's resulting nutrient enrichment can contribute to algae blooms, some of which produce toxins.

Your veterinarian or equine nutritionist can provide advice if you have any questions regarding your horse's dietary P (or other nutrients) content. **UK**

>Mieke Holder, PhD, is an assistant research professor and Ashley Fowler, PhD, is a post-doctoral scholar within the University of Kentucky's Department of Animal and Food Sciences.

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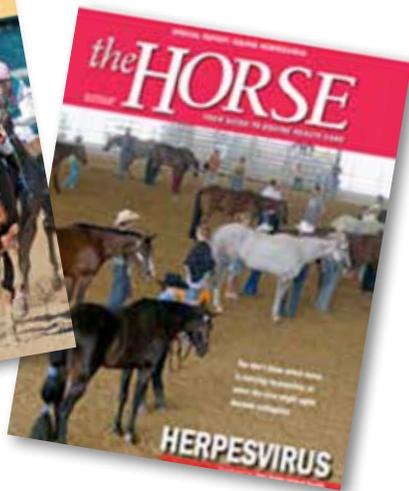
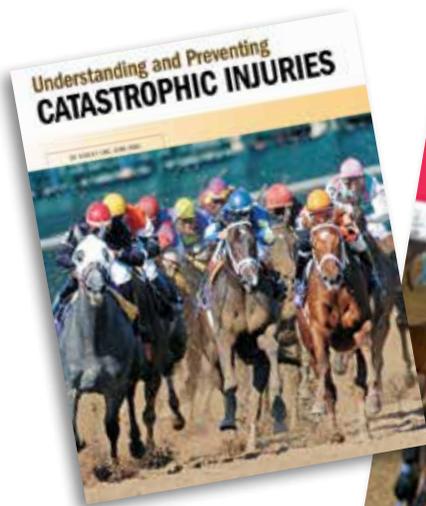
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## Upcoming Events

**October 28-31**

### **Equestricon**

**Location:** Kentucky International Convention Center, Louisville

**Special Note:** On Oct. 29, from 2 to 3 p.m., UK will present a can't-miss seminar for anyone looking to learn more about racing careers from the farm to the track. Claiborne Farm's Walker Hancock, Leah Alessandrini of Bonne Chance Farm, and Jake Memolo of Taylor Made Sales are among several workshop leaders scheduled to share insights and answer attendees' questions.

**October 31 – 10-11 a.m.**

### **Mary Passenger Memorial**

#### **Lecture Series**

**Topic:** Stallion Fertility Cases: Demonstrating the Impact of Translational Research on the Thoroughbred Breeding Industry

**Speaker:** Dickson Varner, DVM, MS, Dipl. ACT, professor of equine theriogenology and Pin Oak Stud Chair of Stallion Reproductive Studies, Texas A&M University

**Location:** UK Gluck Equine Research Center Auditorium

**October 31 – 6-9 p.m.**

### **UK Equine Research Hall of Fame Induction**

**Location:** Hilary J. Boone Center at UK  
Ticketed event—RSVP required

**November 15 – 4-5 p.m.**

### **UK Department of Veterinary Science Equine Diagnostic and Research Seminar Series**

**Topic:** Antimicrobial Diarrhea and Microbiome

**Speaker:** Carolyn Arnold, DVM, Dipl. ACVS, Texas A&M University

**Location:** UK Veterinary Diagnostic Laboratory

**November 15 – 5-6 p.m.**

### **Mary Passenger Memorial Lecture Series**

**Topic:** Pursuing the Cause of Theiler's Disease: A 100-Year-Old Problem

**Speaker:** Thomas Divers, DVM, Dipl. ACVIM, ACVECC, Rudolph J. and Katharine L. Steffen Professor of Veterinary Medicine, Cornell University College of Veterinary Medicine

**Location:** UK Veterinary Diagnostic Laboratory