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KHRC Funds Gluck Center Study Into Catastrophic Injuries in Racehorses



MATT BARTON/UK AG COMMUNICATIONS

Researchers are examining whether inflammatory and anti-inflammatory markers could serve as early indicators for potential catastrophic injuries in racehorses.

The Kentucky Horse Racing Commission (KHRC) has voted unanimously to fund a project at the University of Kentucky (UK) Maxwell H. Gluck Equine Research Center examining inflammatory and anti-inflammatory markers as early indicators for potential catastrophic injuries in racehorses.

Racehorse and jockey injuries during training and racing is a significant economic and welfare concern for the Thoroughbred industry. While there has been increased interest in the development of techniques to identify individual horses at risk for injury, these approaches have not been widely adopted.

“We have a method to detect inflammation in horses and are proposing to determine its utility in the early

detection of impending catastrophic injuries in racehorses,” said Allen Page, DVM, PhD, principal investigator and scientist/veterinarian at the Gluck Equine Research Center.

Scientists have made multiple attempts to use biomarkers as indicators of injury, but the data thus far have shown this isn’t reliable. Instead, researchers will measure mRNA, or the precursors to proteins, from circulating white blood cells.

“Our theory is that these cells pass by areas of bone or soft-tissue damage, which are activated by the damage, and begin producing inflammatory or anti-inflammatory mRNA, which we then measure,” Page explained. “Based on this, our hypothesis for the study is that those Thoroughbred racehorses that experience a catastrophic injury while racing will have evidence of increased inflammation when compared to noninjured horses.”

Researchers working on the two-year, \$164,488 study, titled “Inflammation in Catastrophically Injured Thoroughbreds,” have been collecting samples since January with the help of multiple state and local racing jurisdictions. Page recently spoke with regulatory racing veterinarians to encourage additional participation in the study, as the ultimate goal is to sample 150 catastrophically injured horses, as well as approximately 1,000 uninjured horses, from across North America.

“By using noninjured horses from the same race, as well as horses in the general racing population, we anticipate identifying patterns of inflammation which may be indicative of a specific injury type,” said David Horohov, PhD, co-principal investigator, Gluck Equine Research Center director, and Department of Veterinary Science chair. “This may then be of use in the future to help identify horses that need additional examination before a race.”

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Catastrophic Injuries in Racehorses

Page said while there has been a significant amount of work in the past two decades to take large amounts of data and create models for determining risk factors for catastrophic injuries in racehorses, those models are not being used on a widespread basis yet.

“It’s exciting to think that a single blood sample may be all we need to help identify an individual at-risk horse as we work with the racing industry to further improve the safety and welfare of these incredible athletes,” Page said. **UK**

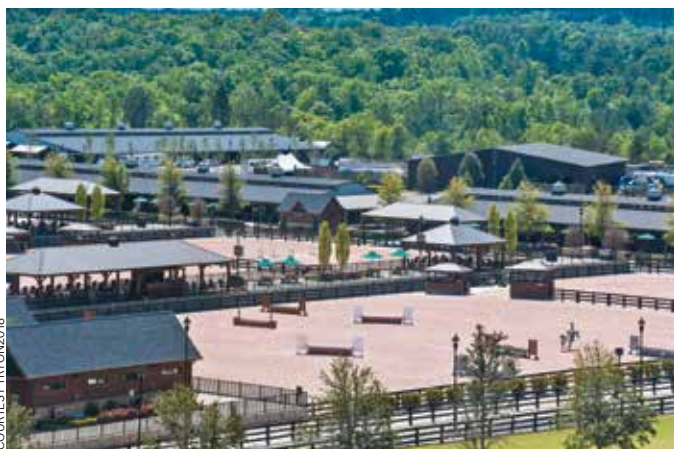
>Jenny Evans, MFA, PhD candidate, is the senior veterinary science marketing and promotion specialist at the UK Gluck Equine Research Center.

Surface Testing, Part 3: Practical Applications for High-Level Competitions

No matter the occasion—be it a horse race, show jumping competition, dressage test, reining pattern, or any of the many other equine sport events that take place every year—all equestrian events have one singular requirement they need to take place: They need an appropriate and safe competition surface. Ensuring proper footing selection, installation, and maintenance is important not only for equine injury prevention, but also for horse and rider safety.

This is the third in a series examining equine competition surface testing and maintenance worldwide.

Mick Peterson, PhD, is the director of UK Ag Equine Programs, faculty member with in UK’s Biosystems and Agricultural Engineering Department, and executive director of the Racing Surfaces Testing Laboratory (RSTL). He co-founded the nonprofit RSTL with Wayne McIlwraith, BVSc, PhD, DSc, FRCVS, Dipl. ACVS, a professor at Colorado State University’s College of Veterinary Medicine and Biomedical Sciences. The RSTL has a 10-year history of examining equine competition surfaces at racetracks and equestrian sports venues around the world, developing protocols and standards, and offering recommendations. In this role, Peterson is considered one of the world’s premiere experts in testing of high-level competition surfaces.



COURTESY TRYON2018

Safe arena footing and maintenance is a priority for the upcoming World Equestrian Games, and RSTL has been working with a team from the Swedish University of Agricultural Science to help construct, install, and maintain the new arenas and surfaces at the TIEC in a relatively short timespan.

In previous installments, we discussed general surface testing practices for both racetracks (TheHorse.com/139419) and arenas (TheHorse.com/155374). Although the details very important, practical applications are even more crucial. In this final installment, we’ll look at applied surface testing practices, specifically pertaining to surfaces that will be used at the upcoming Fédération Equestre Internationale (FEI) World Equestrian Games (WEG), at the Tryon International Equestrian Center (TIEC), in North Carolina, as well as those used at the Winter Equestrian Festival,

Masthead

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Surface Testing: Practical Applications

held at the Palm Beach International Equestrian Center (PBIEC), in Wellington, Florida.

Arena watering and drainage are important elements of proper surface maintenance. The RSTL has been working with Bacher Products GmbH on a subsurface watering system that could be used in arenas such as the ones at PBIEC.

The Wellington facility represents a unique footing challenge, due to Southern Florida's extremely wet environment in addition to the normal requirements—good drainage and properly selected footing materials. Adding to the challenge are Wellington's occasional dry periods, during which arenas must be watered. The new system the RSTL has been testing waters the arena from underneath, while allowing excess water to drain vertically through the footing.

Most arenas (and racetracks) primarily drain water horizontally, in which the surface slopes off in certain areas to allow the water to drain. The vertical drainage system currently being tested combines a novel padded subsystem that, if successful, could be used with for a variety of surfaces in different arena and track environments currently using horizontal drainage with suboptimal results.

"Wellington is a challenging model due to the high usage and environment, so if the vertical drainage and subsurface watering system can hold up there, it can hold up anywhere," Peterson said.

Further north, the TIEC is facing the massive task of preparing to host the 2018 FEI World Equestrian Games, which are expected to attract about 1,000 athletes, 1,500 horses, and 500,000 spectators. Safe arena footing and maintenance is a priority for this prestigious event, and RSTL has been involved with a team from the Swedish University of Agricultural Science, in Uppsala, to help construct, install, and maintain all the new arenas and surfaces in a relatively short timespan.

"Due to the challenging schedule, preparing for WEG has been a real test to get the footing in place and validate

it using FEI standards," detailed in TheHorse.com/155374, Peterson said.

Equestrian Surfaces International provided the footing for all the arenas at the North Carolina facility, and engineers used the Orono Biomechanical Surface Tester (OBST, TheHorse.com/139419 and TheHorse.com/155374) to test the footing as per FEI standards. The OBST represents the horse's trailing front leg on the landing side of the fence, which is a leg and location that has a high level of impact.

"If the surface can handle the trailing forelimb landing impact, it can usually handle everything else, as well," Peterson said. "Show jumping surface maintenance is very challenging. For a racetrack surface you have one clear objective: supporting the hoof of a galloping horse. In show jumping you must account for all the movements of the horse, such as takeoff, landing, and turns."

Once installation is complete, staff will also perform moisture, temperature, and material monitoring to the FEI standards for the WEG surfaces. However, there are other factors that RSTL is not involved with that play into proper surfaces. Peterson said the course designer is a critical player in maintaining footing safety and maintenance. The daily show schedule must also allow enough time for proper maintenance, including dragging and watering the arenas, as necessary. Everyone involved with running the TIEC will work alongside the monitoring team to ensure that the surfaces stay safe and properly maintained for the high level of use and competition that takes place during WEG.

Many equestrians have heard the saying "no hoof, no horse," which could be rephrased to say "no footing, no quality ride." This series highlights the importance of surface testing and maintenance from a safety and fairness standpoint. Whether the surface is handling racehorses thundering down the track, an FEI horse performing the test of his life, or the average rider exercising their horse after work, footing quality and maintenance is paramount. **UK**

>Maddie Regis is a senior marketing major and former communications and student relations intern for UK Ag Equine Programs.

2018 AHP Equine Industry Survey Shows Stabilization, Changes in Horse Health Management

American Horse Publications (AHP) conducted its fourth online nationwide equine industry survey, sponsored by Zoetis, from Jan. 22 through April 1.

With the survey AHP and Zoetis aimed to:

- Gauge participation trends and management practices in the U.S. equine industry;
- Identify critical issues facing the equine industry as perceived by those who own or manage horses; and
- Better understand approaches to horse health care.

As with previous surveys, participation was limited to men and women, 18 years of age and older, who currently own or manage at least one horse and live in the United States. This study was anonymous, meaning no one, not even research team members, are able to associate survey information with responses.

AHP members promoted the survey online and in print, as well as via social media. The survey team collected more than 9,000 usable responses.

C. Jill Stowe, PhD, associate professor



ANNE M. EBERHARDT/THE HORSE

Nearly twice as many respondents are now talking to their veterinarians about the American Association of Equine Practitioners' vaccination recommendations and requesting specific vaccine brands compared to previous surveys.

2018 AHP Equine Industry Survey

of Agricultural Economics at UK, has provided consultation and data analysis services to AHP for all four previous Equine Industry Surveys.

“The 2018 AHP Equine Industry Survey builds upon the 2009-2010, 2012, and 2015 surveys to help understand the trajectory of the equine industry,” she said.

She said this year’s study revealed five main conclusions.

- Continuing the trend from the 2015 study, the U.S. equine industry appears fairly stable based on numbers

of horses owned/managed and numbers of competitions attended. The average number of horses owned/managed is about the same as in 2015, with slightly more senior and idle horses. More than 85% of respondents own/manage the same number or more horses than in 2017, and more than 80% expect to own/manage the same number or more horses in 2019. Moreover, about 93% of respondents who competed (or plan to compete) in 2018 are competing the same amount or more than they competed in 2017. About 93% also plan to compete the same amount or more than they compete in 2019. In addition, younger partici-

pants expect to own/manage more horses and compete more in the future.

- Horsekeeping costs are increasing in different areas. In this year’s survey, veterinary services, labor costs, and animal health products represent the areas in which costs have increased most for horse owners/managers. To some extent, these cost differences are geographical, suggesting a need for awareness of different management concerns across the country.
- Unwanted horses will always be an important equine industry issue, but land-related issues—specifically, loss of trails/riding areas and competition for open spaces from developers and other agricultural uses—are becoming more important to respondents.
- There were significant changes in horse health care management and awareness. Nearly twice as many respondents are now talking to their veterinarians about the American Association of Equine Practitioners’ vaccination recommendations and requesting specific vaccine brands. In addition, more respondents are deworming less frequently, which suggests more horse owners/managers are utilizing fecal egg count tests and deworming accordingly in favor of rotational deworming.
- Science and technology have provided new opportunities to better care for the horses we manage. New product and therapy development give rise to different opportunities for growth in the industry, which does not necessarily have to be measured strictly by number of horses.

“Since horses became obsolete as a tool in transportation and farming, the horse industry has had to embrace a new role where the horse is used for recreation, sport, and entertainment,” said Stowe. “Accordingly, the horse is no longer a ‘necessity’; rather, the horse is generally considered a ‘luxury’ item (though many of us in the industry certainly classify the horse as a necessity!).”

She added that the horse industry is more exposed to fluctuations in general market conditions, as well as competition against other forms of recreation, sport, and entertainment.

But, “according to past and present AHP survey results, nearly 10 years removed from the onset of the Great Recession of 2008-2009, the equine industry appears to have firmly stabilized,” Stowe

GRAD STUDENT SPOTLIGHT

POUYA DINI, DVM, PHD

From: Tehran, Iran

Degrees and institutions where received:

DVM, Karaj Veterinary School at Azad University, in Tehran

PhD in animal reproduction, Azad University in collaboration with Ghent University, in Belgium.

After obtaining his DVM, Pouya Dini started a doctoral training program combined with a residency in animal reproduction. He passed the Iranian National Specialty Board Exam in equine reproduction in 2011. Afterward, he continued his doctoral research at Azad University and Ghent University and obtained his PhD. His research focused on bovine uterine infections.

Over time, Dini became more interested in equine reproduction and applied for an additional PhD program at Ghent University. During the first two years of his doctoral program, his research primarily focused on in vitro (in the laboratory) equine embryo production via intracytoplasmic sperm injection, equine embryo manipulation, and pre-implantation genetic diagnosis. He was then accepted into a residency training program with the European College of Animal Reproduction (ECAR).

In 2015, Dini shifted his research focus to the equine transcriptome and the role of microRNAs during pregnancy and placental development. For that study, Dini began collaborating with researchers from the UK Gluck Equine Research Center, where he is now a visiting scholar.

Dini said he came to UK because “when you want to do research on horses, there is no other place like the Gluck Center.”

Dini is studying under Peter Daels, DVM, PhD, Dipl. ECAR, Dipl. ACT, from Ghent University, and Barry Ball, DVM, PhD, Dipl. ACT, professor and Clay Chair in Equine Reproduction at the Gluck Center. His current research project focuses on mRNA and micro-RNA expression in equine placenta and mare and stallion contributions to placental development and function. Overall, he said, this study will improve the understanding of equine placental development.

Dini said the collaborative research has given him “the chance to work and share ideas with some of the smartest researchers in the equine industry.”

Dini plans to finalize his research projects in early 2019, take the American College of Theriogenologists and ECAR exams, and obtain a faculty position. **UK**



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

2018 AHP Equine Industry Survey

reported. "Industry participants have made great strides in addressing important issues, such as the unwanted horse issue, and now have their sights focused on additional challenges, such as the scarcity of riding areas and open spaces."

Christine W. Brune, AHP executive director, said, "We are thrilled with the

cooperation of our members, the industry respondents, and Dr. Stowe in conducting this fourth survey. The Equine Industry Survey is an important project for American Horse Publications and demonstrates that our association can provide vital information for the equine industry through the power of the media. AHP is grateful for its partnership with Zoetis to provide ongoing and vital data on the trends in horse care, management, and welfare of horses in the U.S."

AHP members who promoted the survey will receive complete results to showcase through their own channels prior to release of the survey results to the full AHP membership. The general equine industry can request a summary of this new information by contacting the AHP office at ahorsepubs@aol.com after Oct. 1. [UK](#)

>Press release by AHP Executive Director Christine Brune.

Rabies in the Horse and Beyond in Kentucky

Rabies virus exposure typically occurs following a bite from an infected animal. Depending on the anatomic site of exposure, an incubation period of variable duration follows as the virus evades the immune response by hiding in the central nervous system. Virus amplification occurs in the dorsal root ganglion (a cluster of neurons in a dorsal root of a spinal nerve) after which it travels towards the brain via the spinal cord. At this point, clinical signs of rabies become manifest and therapy is almost invariably futile. Without early treatment, rabies is nearly 100% fatal.

Rabies is a zoonotic (capable of being transmitted from animals to humans) disease that is distributed nearly worldwide. Attention to the disease is primarily focused on preventive and control strategies. Many countries are considered rabies-free for the purposes of importing dogs into the United States; learn more at cdc.gov/importation/rabies-free-countries.html.

Rabies can be prevented by pre-exposure vaccination in both humans and animals. A human diploid cell vaccine and a purified chick embryo vaccine are available for humans (the latter is mainly used outside of the U.S.) for pre- and post-exposure to rabies, with rabies immune globulin available only for post-exposure treatment in exposed humans.

Pre-exposure vaccination involves administration of three doses of vaccine given over a one-month period. In unvaccinated humans, post-exposure treatment consists of the administration of five doses of vaccine. Vaccines for multiple species of domestic animals, including horses, are available to licensed veterinarians. Wildlife vaccines might be available from veterinarians but are typically used in targeted locations by the Kentucky Department of Fish and Wildlife and the USDA.

From January 1989 through December 2017, Kentucky tested 32,387 animals for rabies virus. Of this total, 2.3% (733 animals) tested positive, 93.1% (30,145 animals) tested negative, and 4.6% (1,509 animals) were unsatisfactory for testing (i.e., the sample was untestable due to maceration, degradation, or insufficient material). Of note: Animals suspected of having rabies should not be euthanized by traumatic insult (e.g., gunshot) to the brain because such trauma frequently renders the sample unsatisfactory for testing.

Of the 733 positive animals, only 7.2% (53 animals) were from domestic species (pets and farm animals), and the other 92.8% (680 animals) were wildlife. Just 25 of the positive

Rabies in the Horse and Beyond in Kentucky (page 5):

Table 2. Rabies virus test results broken down by wildlife, domestic species (excluding horses), and horses.

Results	Wildlife	Domestic Species (excluding horses)	Horses	TOTAL
Negative	12,378	16,733	1,034	30,145
Positive	680	28	25	733
Unsatisfactory specimen	823	675	11	1,509
TOTAL	13,881	17,436	1,070	32,387

Figure 1. Geographic location of the 25 horses testing positive for rabies virus in Kentucky from 1989 to 2017.

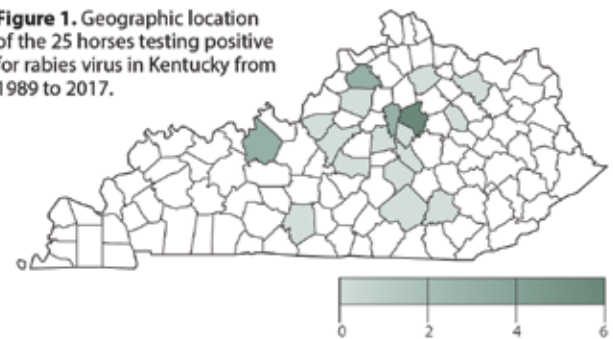
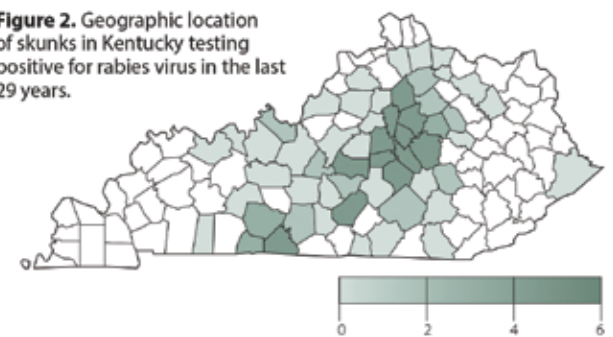


Figure 2. Geographic location of skunks in Kentucky testing positive for rabies virus in the last 29 years.



domestic animals were horses, which means that horses accounted for less than 1% of the total positive rabies cases in Kentucky over the last 29 years. Rabies-positive horses were primarily located in Central Kentucky (Figure 1).

The terrestrial reservoir for rabies in Kentucky is the striped skunk, and rabies-positive skunks have been located in all

Rabies in Kentucky

counties where infected horses have resided (Figure 2, on the previous page).

As a closing comment, a robust surveillance program involving the University of Kentucky Veterinary Diagnostic Lab, Breathitt Veterinary Center, the

Kentucky Cabinet for Health, Kentucky Fish and Wildlife, and USDA is in place to thoroughly monitor rabies in Kentucky. The vast majority of animals testing positive for rabies are wildlife, with little or no exposure to humans, pets, and domestic animals. More importantly for horse enthusiasts within the state, the number of horses testing

positive for rabies is extremely low.

CONTACT: Jacqueline Smith, PhD—jsmit8@uky.edu—859/257-7559—UK Veterinary Diagnostic Laboratory, Lexington **UK**

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

Watch Out For Wasps in Horse Barns and Sheds

Q I've noticed a lot more wasps in horse barns around our property this year. They seem to be more easily aggravated, too—both my dad and sister were stung in the past two weeks. We even had a close encounter with a wasp getting stuck between a neck sweat and my gelding's mane. Do you have any suggestions for deterring them?

Sarah, Indiana

A Several kinds of wasps can be problematic because nooks and crannies around barns and sheds provide good nesting sites. Paper wasps and mud daubers commonly build their nests under eaves and overhangs. Generally, these insects are not aggressive until late summer. Colonies are at



Several kinds of wasps can be problematic for horse owners because nooks and crannies around barns and sheds provide good nesting sites.

peak numbers then, and caterpillars that are the bulk of their diet are becoming harder to find. The wasps seem more likely to go after people and horses that invade "their space."

Large European hornets might build nests in wall voids. They, too, are more aggressive late in the season, sometimes

attacking without obvious provocation. Dry weather also spurs conflicts with wasps and hornets. They visit water tanks more frequently when puddles and other normally wet areas are scarce because of increased demand to cool and hydrate larvae developing in the nest.

As with many pest problems, preventing wasps in horse barns is the key. Watch overhangs and favored nesting areas in early summer, when overwintering queens start building their nests. Check nesting areas weekly during this establishment period. It's much easier to deal with a single queen or a few workers when the nest is small than later when numbers are higher. Swatting with a broom or using a wasp and hornet spray can be very effective. Remember that good nesting sites will always be attractive, but preventing establishment early will prevent problems later. **UK**

>Lee Townsend, MS, PhD, is an entomologist in the UK College of Agriculture.

The Probiotic and Prebiotic Puzzle

If you've watched television or flipped through a lifestyle magazine lately, you've probably seen advertisements for health products, such as yogurt, that "contain live cultures," touting their benefits to your digestive system. Perhaps you even use one of these probiotic supplements yourself or give one to your horse. There are so many different species of microorganisms in the horse's gut, however, that it's difficult to know if a probiotic supplement is the type needed to benefit his well-being.

What researchers do know is that the equine gut microbiome (microbe population) is important for overall health.

"We tend to forget that a significant percentage of the immune system is located in the gut, which is critical for regulating immune homeostasis (stability) and health," says Amanda Adams, PhD, assistant professor at the UK Gluck Equine Research Center.

The exact type and number of microorganism species present depends on the individual horse's diet. Some common

species found in horses are beneficial—a major reason why owners should make dietary changes slowly. Sudden changes to this delicate internal ecosystem can result in colic, colitis, and laminitis. Because we're paying more attention than ever to promoting a healthy microbial population in our horses, a number of supplements with labels claiming health benefits have arrived on the market. These claims might or might not be backed by scientific research.

So, what do probiotics and their counterparts—prebiotics—do? Here we'll define both and review the current research.

Digestive Health Products

Probiotics—The World Health Organization (WHO) defines probiotics as live microorganisms that, when administered at adequate concentrations, confer a health benefit to the host. When ingested, probiotics can help improve digestion and provide nutritional benefits, such as the production of B-vitamins necessary for metabolism.¹ Probiotics are also called direct-fed microbials (DFMs) and are intended to provide horses with live colonies of lactic acid-producing bacteria

The Probiotic and Prebiotic Puzzle

(LAB), which are found naturally in healthy animals' intestines.

Common LAB species include *Lactobacillus*, *Bifidobacterium*, and *Enterococcus*, which, according to a 2014 study by Schoster et al., might help reduce or prevent the growth of potential pathogens (disease-causing organisms) such as *Clostridium botulinum* (which causes the life-threatening neurologic disease botulism). LAB produce vitamins, enzymes, and volatile fatty acids (used in energy production), all of which might aid digestion, provide nutritional value, and promote gastrointestinal (GI) health, state authors of the National Research Council's 2007 *Nutrient Requirements of Horses*.

Researchers have questioned probiotics' ability to endure manufacturer processing and storage. But the WHO has determined that species such as the LAB *Bacilli* can form spores resistant to harsh conditions, increasing their likelihood of survival.

Yeast—These single-celled organisms are part of the fungus family. Researchers believe yeast products, including yeast culture, yeast extract, and active dry yeast, contain compounds that facilitate fiber digestion and stimulate the growth of "good" bacteria involved in digestion.¹ Most yeast products come from *Saccharomyces* cultures (*S. cerevisiae* or *Aspergillus oryzae*). *Nutrient Requirements of Horses* defines yeast culture as a dried product that contains viable yeast cells and the culture media on which the yeast grew. It defines yeast extract as a dried or concentrated result of ruptured *S. cerevisiae* cells. Active dry yeast (dormant yeast cells that become active when dissolved in water) simply must contain 15 billion live yeast cells per gram.

Based on studies of yeast cultures, it appears that yeast can survive transit through the digestive tract.

Fermentation products—These are also marketed as benefiting digestive health. Fermentation products are byproducts of bacterial growth and not live organisms. Therefore, they aren't technically probiotics.¹ These byproducts might contain LAB-produced enzymes, but there is limited evidence to support any major health benefit from their use.



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The wide variability among microbe species and horses' microbiomes make pro- and prebiotic research challenging.

Probiotics Research

Researchers believe probiotics exert health benefits by preventing pathogenic bacteria from colonizing in the GI tract. Probiotics generate antimicrobial factors, stimulating the immune

system and winning the competition for nutrients necessary to survive. Probiotics also stimulate the production of antibodies necessary to neutralize pathogens and can stimulate anti-inflammatory processes.²

Unfortunately, our understanding of how to use probiotics and how effective they are in horses is extremely limited.

"Microbiome research in the horse is expensive," says Louise Southwood, BVSc, PhD, Dipl. ACVS, ACVECC, of the University of Pennsylvania's New Bolton Center, in Kennett Square. This makes it challenging for researchers to obtain funding to pursue the necessary large-scale studies to answer many questions about probiotic use. Most research has been conducted in other species, and the data from humans and ruminants might not be applicable to horses.

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The limited studies in horses have yielded lackluster data. In 2015 Schoster et al. compared the effect of a newly designed probiotic on diarrhea incidence in 24 healthy foals to 24 control foals that received a placebo. They found no difference in diarrhea incidence between treatment groups and, in fact, noted that foals treated with probiotics were more likely to develop diarrhea requiring veterinary intervention. In a study of adult horses, Parraga et al. concluded that probiotic supplementation did not prevent postoperative diarrhea or *Salmonella* shedding.

These studies are complicated by the fact that microbial populations vary in different parts of the digestive tract, making it harder to interpret data and draw definitive conclusions. Different strains of microorganisms of the same species might also produce different results, making it more difficult to offer broad generalizations.

Research showing that ingested microorganisms can actually colonize the equine intestinal tract and are safe and beneficial to it is also extremely limited. However, horses fed LAB and yeast have shown signs of improved fiber digestibility with both high-fiber and high-starch diets (Agazzi et al., 2011), suggesting these microorganisms can survive oral ingestion long enough to provide at least some benefit to the horse.

In a 2014 study Furr et al. looked at the potential benefits of *Pediococcus acidilactici* and *Saccharomyces boulardii* for boosting the immune system. Although results were promising, these species have not been fully evaluated, and more research is needed to understand if and how they work.

Lastly, the bacterial species most commonly used in probiotics for horses, including *Lactobacillus*, *Bifidobacterium*, and *Enterococci*, probably aren't even the most abundant in the large colon. Studies of more populous species, such as members of the *Clostridia* class, are lacking, but they could potentially be of real value to equine gut health.²

While Southwood has clinical and research interests in equine gastrointestinal disease, especially that which causes colic, she says "we just don't

know exactly what works and what doesn't" when it comes to probiotic supplementation.

Yeast Product Research

Research into yeast's effects on digestion have produced clearer findings. In a 2008 study of the effects of supplementary yeast culture (*S. cerevisiae*), Jouany et al. found that it improved fiber digestibility and amount of feed intake in horses. In additional research Agazzi et al. found that supplementing the diets of Italian Standardbreds consuming 70% forage and 30% grain concentrate diets with live yeast improved their fiber digestibility. Yeast culture supplementation improved horses' ability to digest low-quality Bermudagrass hay when compared to horses receiving no supplement. It did not, however, affect the digestibility of high-quality hay.³ All these study results indicate yeast culture has the potential to boost horses' nutrient use when they are consuming lower quality forage.

When it comes to protein, some study results have shown improved protein digestibility in horses receiving yeast culture,⁴ while other data have been borderline.⁵ More research is needed to determine if yeast culture benefits protein digestion.

In a 2008 study out of Colorado State University, researchers concluded that feeding a combination of probiotics, prebiotics, and psyllium increased sand clearance in healthy horses (that had inadvertently ingested it). Previous studies on the effectiveness of psyllium alone in removing sand from the gut, which helps prevent colic, have yielded mixed results. More research is needed to draw definitive conclusions regarding yeast's efficacy in promoting sand clearance.

Prebiotics Research

Prebiotics are nonliving, nondigestible food ingredients that benefit the host by stimulating nonpathogenic intestinal microbe growth and/or activity. In other words, prebiotics are food for the probiotics. Common examples of prebiotics in equine diets include beet pulp, oat hulls, soy hulls, and fructooligosaccharides (FOS), all of which microbes can ferment.

Commercial grain concentrates and supplements also commonly include mannan-oligosaccharides (MOS). These adhere to and inhibit pathogens but do

not have a direct effect on the microbial population. So, while MOS appear to have a health benefit by preventing the "bad bugs" from proliferating, by definition they're not prebiotics (even though they're commonly referred to as such).

"MOS are also thought to act as immunomodulatory in either decreasing or increasing immune responses," says Adams. "With this being said, more research is needed to fully understand the effects of MOS on immune function."

Prebiotics offer certain advantages, as far as feed production, supplementation, and storage. The organisms don't have to be live and viable, and they help protect probiotics during processing and storage. It is important to store such ingredients properly (sealed, in a cool, dry place) and make sure they are part of a well-balanced diet for maximum effectiveness.

Last year, researchers at Texas A&M University found that prebiotic supplements that contain FOS or MOS improved horses' ability to digest high-fiber diets. The team found that FOS reduced alterations in microbial populations despite abrupt dietary changes, potentially reducing the risk of digestive upset.

Direct Health Effects

Each horse has a unique microbiome, but certain phyla predominate within the population in healthy horses. These include *Clostridiales*, *Actinobacteria*, and *Spirochaetes*, whereas horses suffering from diarrhea have an increased population of *Fusobacteria*. Interestingly, researchers have found little difference in LAB populations between healthy and diseased horses,² but that doesn't necessarily mean LAB don't have other positive influences on the gut. More research is needed to determine how different bacterial species affect various disease states.

After colic surgery, diarrhea can be a major problem, especially in horses receiving certain drugs. "Probiotics may be useful in horses on antimicrobial medication," says Southwood. "We know that antimicrobials disrupt the microbiome, and supplementing a probiotic, while not proven to work, may help and hopefully is not detrimental."

Age Matters

Foals are born with a sterile gut, but microbial colonization occurs quickly, and a mature microbial population develops within the first few weeks of

The Probiotic and Prebiotic Puzzle

life. Therefore, it's likely that probiotics affect foals, especially neonates, differently than they do adult horses due to differences in GI tract microbial populations. Although probiotics are generally considered safe, the microbial population in the young horse's GI tract might be more vulnerable to manipulation, potentially resulting in imbalances and diarrhea. Generally, veterinarians don't recommend probiotics for newborn foals.² In addition, probiotics are not likely to enhance feed utilization and/or growth and development in young horses fed a well-balanced diet.

The diversity of horses' gut microflora changes continually. "With age," Adams says, "changes in the immune system occur that result in low-grade inflammation, or inflamm-aging." In her research she found that "nutritional

intervention with prebiotic supplementation can be beneficial in supporting the immune system of the aged horse."

Take-Home Message

We still have much to learn about both pro- and prebiotics. The cost of research and the wide variability among individual microbiomes make drawing definitive conclusions challenging. Different health concerns might warrant different probiotics, and a better understanding of the efficacy of more bacterial species is needed.

On top of that, researchers still don't know how much probiotic or prebiotic to administer to be effective without overriding the horse's system, says Adams. We know prebiotics do, however, provide nutritional support for the proliferation of a healthy microbial population in the equine digestive tract. More research is needed to answer the many questions regarding both probiotic and prebiotic use in horses. **UK**

>Nettie Liburt, MS, PhD, PAS, is an equine nutritionist based on Long Island, New York.

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LMU Students Present Summer Research Projects

Eight veterinary students from Lincoln Memorial University, in Harrogate, Tennessee, spent their summers at the Gluck Equine Research Center conducting research projects with faculty, graduate students, and other laboratory members.

The students presented their research at the end of July at the UK Veterinary Diagnostic Laboratory.

The presentation titles, along with student presenters and mentors, included:

- "Pilot study: The relationship of exercise training, inflamm-aging and muscle mass in senior horses," by Bertie Cantu (Mentor: Amanda Adams, PhD);
- "Characterizing compositional and mechanical changes of equine proximal sesamoid bones associated with catastrophic race failure," by Danielle Howard (Mentored by Jamie MacLeod, VMD, PhD, and the staff in his musculoskeletal science laboratory);
- "Development of a genetic test for HYPP during embryo transfer in the horse," by David Alexander (Mentor: Alex Esteller-Vico, DVM, PhD);
- "Effect of varying nutrient content on insulin responses in healthy and insulin dysregulated horses," by Katelyn Jaqueway (Mentor: Adams);
- "Evaluating the susceptibility of *Rhodococcus equi* to silver-based antimicrobials," by Lynn Leedhanachoke (Mentor: Carrie Shaffer, PhD);



JENNY EVANS

Back row (left to right): Morgan Clark, Martin Nielsen, Amanda Adams, Alex Esteller-Vico, Alisa Herbst, David Alexander, and Jamie MacLeod.
Front row (left to right): Carrie Shaffer, Sofia Santacaterina, Olivia Walker, Lynn Leedhanachoke, Bertie Cantu, Katelyn Jaqueway, Erica Macon, and Danielle Howard.

- "March comes in like a lion and out like a strongyle?" by Morgan Clark (Mentor: Martin Nielsen, DVM, PhD, Dipl. ACVM);
- "In vitro effects of the synthetic progestin altrenogest on peripheral blood mononuclear cell," by Olivia Walker (Mentors: Adams; Barry Ball, DVM, PhD; and Carleigh Fedorka, PhD); and
- "The effect of NSAID administration on inflammatory mRNA expression," by Sofia Santacaterina (Mentors: David Horohov, PhD, and Allen Page, DVM, PhD) **UK**

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

Horse Pasture Renovations Benefit Lexington Thoroughbred Farm



Mill Ridge manager Marc Richardson said the farm lost no mares or foals during the 2018 foaling season after undertaking extensive pasture renovations.

DR. JIMMY HENNING

A Kentucky Thoroughbred farm is reaping the benefits of healthier mares and foals after making horse pasture renovations over the past year with guidance from UK College of Agriculture, Food and Environment personnel.

In 2017, Mill Ridge Farm, in Lexington, experienced significant foaling problems which farm manager Marc Richardson believed were linked to fescue toxicity.

“Last year, we had multiple foalings that required veterinarians to come out,” he said. “We also had mares that did not have any milk production.”

At the suggestion of the farm’s veterinarian Stuart Brown, DVM, Richardson contacted UK forage extension specialist Jimmy Henning, PhD, and Krista Lea, MS, program coordinator for UK’s Horse Pasture Evaluation Program, for help.

“The Horse Pasture Evaluation Program really started to help horse farms better understand pasture management and look at fescue toxicity,” Lea said. “Over the years, we have increased the size and the scope of the program primarily due to demand.”

Henning and Lea met with the Mill Ridge personnel and collected forage samples from pastures frequented by pregnant mares. They had the samples

analyzed and the results confirmed that tall fescue in some of the pastures had high levels of ergovaline—a toxin produced by endophyte-infected tall fescue that affects pregnant broodmares.

Henning and Lea made recommendations, including completely killing off two fields with the highest ergovaline levels and reseeding them with bluegrass, orchardgrass and a little perennial ryegrass to help with forage establishment. This meant taking those two fields out of production for almost a year. The pair recommended only removing the fescue in other fields.

“We targeted the pastures that supported mares in the last third of gestation,” Henning said. “It lent itself to a narrow range of options and a focused response.”

Richardson and other Mill Ridge personnel are pleased with the results.

“It is a complete 180 from last year,” Richardson said. “This year, we lost no mares or foals. The pasture renovations are what turned our foaling season around.”

Richardson said the farm plans to renovate one field each year until they remove fescue from all the fields through which pregnant mares rotate.

“It’s a big investment, especially the

pastures we totally killed off and reseeded, but when you compare it to the cost of one trip to the clinic with a mare and foal or the loss of a foal, it’s not really very expensive,” he said.

Horse farm owners and managers who are interested in learning more about pasture evaluation should start with their county extension agent for basic recommendations and help in taking soil samples. They can get more detailed recommendations and samplings through UK’s Horse Pasture Evaluation Program. [UK](#)

>Katie Pratt is a communication specialist with UK’s College of Agriculture, Food and Environment Agricultural Communications.



Marc Richardson shares his thoughts on pasture renovations at youtube.com/watch?v=SdLInefKQTY

Mineral of the Month: Fluorine

Fluorine is a trace element most commonly found in nature in its less reactive form, fluoride (F^-). Although fluorite carvings from ancient times exist and it's thought artisans used fluorite combined with a strong acid for glass etching, there's very limited information on F^- use in historic times.

Scientists have long known that, in large quantities, fluorine is a toxic element and have been evaluating its toxic properties since the mid-1800s. In appropriate amounts, however, F^- can be beneficial to bone and tooth health, increasing their crystallinity and hardness and decreases their overall solubility. Consequently, some communities around the world with low water F^- content have chosen to add F^- to their public water supply, following recommendations and guidelines set forth by authorities such as the World Health Organization.

Scientists have studied F^- deficiencies in rats consuming experimental diets. However, there have not been any reports of F^- deficiency in horses. This could be, in part, because F^- is present throughout the earth's crust. Soil F^- concentrations vary from one area to the next, which is also reflected in the wide range of F^- concentrations reported for the forages horses typically consume.

Water is another source of F^- for horses. Water F^- concentrations vary based on soil and underlying rock F^- content, soil pH, and water hardness (National Research Council's *Mineral Tolerance of Animals* [NRC], 2005). Typically, ground water F^- concentrations range from 0.02 to 1.5 mg/L (milligrams per liter) but could be higher in parts of the Southwest United States (NRC, 2005). The U.S. Environmental Protection Agency allows a maximum of 4 mg F^- /L in drinking water for human consumption (NRC, 2005). In areas known to have F^- toxicity problems, deep-well water can have F^- concentrations in excess of 5 mg F^- /L (NRC, 2005).

Fluorosis (or F^- toxicity) occurs when an individual consumes excessive amounts of F^- . Early signs of fluorosis can typically be noted in younger animals' teeth. Signs of more advanced fluorosis can include unthriftiness,



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The NRC set the maximum tolerable level for horses at 40 mg F^- per kg of dietary dry matter (total dietary intake), but noted that level could decrease if horses' drinking water exceeds 3 mg F^- /L.

standing with an arched back, and rough hair coats. As fluorosis progresses, thickening of bones, stiffness, and lameness can occur.

The National Research Council has set the maximum tolerable level for horses at 40 mg F^- per kilogram of dietary dry matter (total dietary intake), based on research in other species. They do note that the maximum tolerance level could be lower if horses' drinking water exceeds 3 mg F^- /L (NRC, 2005).

Consult your equine nutritionist or veterinarian if you have concerns about your horse's F^- intake. **UK**

>Mieke Holder, PhD, is an assistant research professor within the UK Department of Animal and Food Sciences.

Upcoming Event

Sept. 20 – 4-7:30 p.m.

UK Department of Veterinary Science
Equine Diagnostic and Research
Seminar Series

Topic: EHV Symposium

Location: Malone's Prime, 3373 Tates
Creek Road, Lexington, KY

For more information and to register, visit ehvsymposium.eventbrite.com.

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Gluck Center to Host EHV Symposium

The UK Gluck Equine Research Center will host an Equine Herpesvirus Symposium and Dinner on Thursday, Sept. 20, from 4-7:30 p.m., at Malone's Prime in Lexington. The event is sponsored by the Kentucky Association of Equine Practitioners.

This event is specifically geared toward equine practitioners and researchers. Limited seating is available for the symposium; once the event is full, a waitlist will be established. The \$25 ticket includes the symposium, appetizers, and a three-course meal. A cash bar will also be available.

Three hours of continuing education credit has been approved by the Kentucky Board of Veterinary Examiners for veterinarians and veterinarian technicians.

For a complete schedule and to register, visit ehvsymposium.eventbrite.com. **UK**

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