

HIGHLIGHTING RESEARCH
AND OUTREACH EFFORTS AT
THE UNIVERSITY OF KENTUCKY

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EQUINE SCIENCE REVIEW

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Food and Environment

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Photo courtesy Dr. Jimmy Henning.

VACCINES - WHERE WOULD WE BE WITHOUT THEM?

The extraordinary rate at which biotech companies rolled out vaccines in response to the global pandemic of SARS-CoV-2, aka COVID-19, is unprecedented. Typically, vaccine development and trials take five to 10 years. The ability to move so quickly on the COVID-19 vaccine has a lot to do with the billions of dollars provided for vaccine development but also because vaccine research was built on centuries of science.

During the next series of 'Science Sleuths,' we will be looking at vaccines and how they differ. First, let's look at the history behind this area of science that has had such a massive impact on global health during civilization.

THE THOUGHT OF A WORLD STILL RACKED BY DISEASES SUCH AS THE VIRAL DISEASE SMALLPOX WITH A MORTALITY RATE OF 20-80% IN AFFECTED INDIVIDUALS IS COMPLETELY UNTHINKABLE.

The 'small pocks,' so named to distinguish it from the 'great pocks' that syphilis sufferers exhibited, had been a scourge on civilization for more than 3,000 years. A pock is a blister and it is filled with millions of infective viruses.

The number of people who died from smallpox between 1867 and 1977 is estimated at half a billion, and those that survived frequently became blind (approximately 30%) and all bore the scars of the pocks. The estimated global population in 1900 was 1.65 billion people, in 1950, 2.5 billion and in 2000, 6.14 billion. The death toll from small-



PHOTO BY THIRDMAN FROM PEXELS.

pox is indeed horrific, but when placed in the context of the smaller global populations through the ages, its deathly shadow becomes even more sinister. Smallpox was finally eradicated by vaccination in 1977 as a result of the herculean efforts of the World Health Organization to vaccinate at least 80% of the world's population.

The concept of priming the immune system with a smaller dose or less virulent disease pathogen is something noted throughout history in various precarious and haphazard forms. It was not until the pioneering work of the great scientist Edward Jenner that the medical profession firmly put vaccine research on the map. The story goes that Jenner, as a young surgeon and apothecary apprentice [c.1752], heard that dairymaids were protected from smallpox [Variola virus] after they had had cowpox [Vaccinia virus].

At that time the risky practice

of 'variolation' was common. This involved inoculating a person with a small amount of smallpox blister fluid, hoping that the person survived and did not get the fulminant disease, spread it to others and possibly die. Jenner adapted this practice by using cowpox blister fluid as the inoculum. In doing so, he noted that recipients did not get very sick, survived and were immune to smallpox. It took many years for Jenner's work to be accepted by the medical profession at large. His method of 'vaccination' demonstrated that use of a less virulent but related virus could induce protection against the virulent virus, smallpox. It set the stage of vaccine science for centuries to come and led to the eradication of the global scourge of smallpox.

Fowl cholera is a disease that can kill up to 80% of a chicken flock. To put that in perspective, here in Kentucky, our poultry industry is worth \$1 billion per year



PHOTO BY KOROLINA G. RABOWSKA FROM PEXELS.

and accounts for 18% of the state's farm revenue (<https://www.kyfoodandfarm.com>). In 1879, Louis Pasteur, another amazing scientist, was able to isolate a pure growth of the culprit bacterial organism that he demonstrated caused this devastating disease. The bacterium was named *Pasteurella multocida*. Pasteur found that tiny amounts of the bacterial isolate would kill hens but when he fed a "denatured and untended" culture, the hens became immune to the live bacteria. In this method, the attenuation of the bacteria was a result of how it was cultured and its exposure to heat. The altered bacteria retained the elements necessary to produce an appropriate and protective immune response but lost the ability to cause fatal disease.

What is striking about these examples is how important it is to have our food supplies and our human population protected by vaccination. From the example of smallpox, we also know that it takes a huge, concerted commitment and a high percentage of herd immunity to eradicate a disease and keep ourselves, our loved ones and our livestock safe.

| *Emma Adam, DVM, PhD, DACVIM, DACVS, is based at the University of Kentucky Gluck Equine Research Center and Veterinary Diagnostic Lab and is responsible for research and serves as a veterinary industry liaison. Jackie Smith, PhD, MSc, MACE, Dipl AVES, is an epidemiologist based at the University of Kentucky Veterinary Diagnostic Lab.*



UK GLUCK CENTER AND INDUSTRY LEADERS RESPOND TO UPTICK OF FOAL DIARRHEA CASES



PHOTO COURTESY UK COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT.

The first several months of the year make up the bulk of the busy foaling season in Central Kentucky, so when the region's farms and equine practitioners began noticing increases of diarrhea in foals ages 2 to 7 days old, there was concern.

In response, the University of Kentucky Gluck Equine Research Center is using a portion of its existing Koller Emergency Funds, and the Kentucky Thoroughbred Owners and Breeders Foundation, Grayson-Jockey Club Research Foundation and Coolmore America are leading an effort to help provide additional funding, allowing research to begin immediately. "Anytime we recognize an increased incidence in equine health cases, such as foal diarrhea, we

prepare and mobilize to further our understanding of the health issue," said David Horohov, chair of the Department of Veterinary Science and director of the Gluck Equine Research Center. "Early detection and rapid diagnostics are at the cornerstone of what drives our research approach."

Foals commonly develop diarrhea a week to 10 days after foaling, and veterinarians and farm owners typically have the experience and tools to respond. According to the American Association of Equine Practitioners, it is important for a veterinarian to evaluate foals under a month old when they experience diarrhea because they can develop life-threatening dehydration in as few as six to eight hours. Neonatal or young

foals have a digestive tract, similar to humans, where small intestines are responsible for much of their nutrition absorption. Dealing with this type of attack on the small digestive system heavily impacts foals, which is a big reason why the Gluck center will focus its research efforts on this issue.

A significant increase in the illness has affected some farms, while other farms have had few to no cases. In spite of these incidences, UK has not recognized a rise in reported mortality associated with these cases and continue to monitor the situation.

UK College of Agriculture, Food and Environment researchers have developed a multipronged research plan to help further the understanding of the problem.

One focus of this research plan is to expand scientists' knowledge of the foal gut environment. This will add to their understanding of neonatal gut bacteria and the effect of antibiotic treatment.

A second part of the research plan is to study the differences in mares and their foals on farms both with and without early neonatal diarrhea cases and the effect of antimicrobial drug treatment. Researchers will conduct this analysis through gene sequencing to determine an overview of type and diversity of gut microflora.

They will also use the data in this part of the study to gain insight into the effect of antimicrobial use in foals on the development of their gut microflora.

The third prong of the research will investigate a biotherapeutic approach on one farm. That farm is supplementing foals with home-fermented live yogurt instead of a commercial pre/probiotic. Research has shown that *Lactobacillus* spp. bacteria are among the first colonizers in the neonatal gut. Data from other species supports *Lactobacillus* spp. as promoting gut health and outcompeting pathogens in gut colonization.

In addition to the three studies, the UK Gluck Center and Veterinary Diagnostic Laboratory team has identified further potentially useful tests, including gene sequencing targeting identification of novel viruses and bacteria that may be present.

With limited Kollar Emergency Funds available, the UK Gluck Equine Research Center is thankful for the additional dollars provided by the Kentucky Thoroughbred Owners and Breeders Foundation, The Grayson-Jockey Club Research Foundation and Coolmore America.

"The foundation members met March 15 and felt this research and timing was consistent with the sole mission of immediately responding



PHOTO COURTESY UK COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT.

to threats to the breeding industry in Central Kentucky. We are grateful to Gluck for accessing their emergency funds and everyone for responding so quickly," said Jimmy Bell, chairman of the KTOB Foundation.

"Situations such as these highlight the relevance for a coordinated effort that can be led by our scientists at the Gluck Equine Research Center," said Stuart Brown, veterinarian, Keeneland equine safety director and chair of the Gluck Research Foundation. "Our team mobilizes to work with equine practitioners and farms throughout the area, allowing us to further our understanding and develop our approach to work on these types of issues. We appreciate the opportunity to collaborate with other partners to enhance our abilities when issues like this arise."

"We at Grayson-Jockey Club Research Foundation believe in supporting timely equine health for all horses at every stage of their lives, and foal diarrhea is proving to be a concern this year on Central Kentucky farms," said Dell Hancock, chair of the foundation. "We are happy to help facilitate research to address this condition and thank the University of Kentucky's Gluck Equine Research

Center for their commitment to the well-being of horses."

The mission of the Gluck Center is scientific discovery, education and dissemination of knowledge for the benefit of the health and well-being of the horse.

Mission: KTOB Foundation maintains emergency funds to rapidly counter economic and existential risks to Thoroughbred breeding in Central Kentucky. It is the custodian of funds raised during the mare reproductive loss syndrome (MRLS) in 2001. Since then, it has funded over \$2 million in vital research as well as redevelopment of an infectious disease laboratory at the Gluck Equine Research Center in 2018. It is administered by the Kentucky Thoroughbred Association.

Grayson-Jockey Club Research Foundation is traditionally the nation's leading source of private funding for equine medical research that benefits all breeds of horses. Since 1983, the foundation has provided more than \$30.6 million to fund 396 projects at 45 universities in North America and overseas. Additional information about the foundation is available at grayson-jockeyclub.org.

| *Holly Wiemers, MA, APR, is the communications and managing director for UK Ag Equine Programs.*

UK STUDENTS WORKING TO DEVELOP SAFETY STANDARD FOR EQUESTRIAN HELMETS

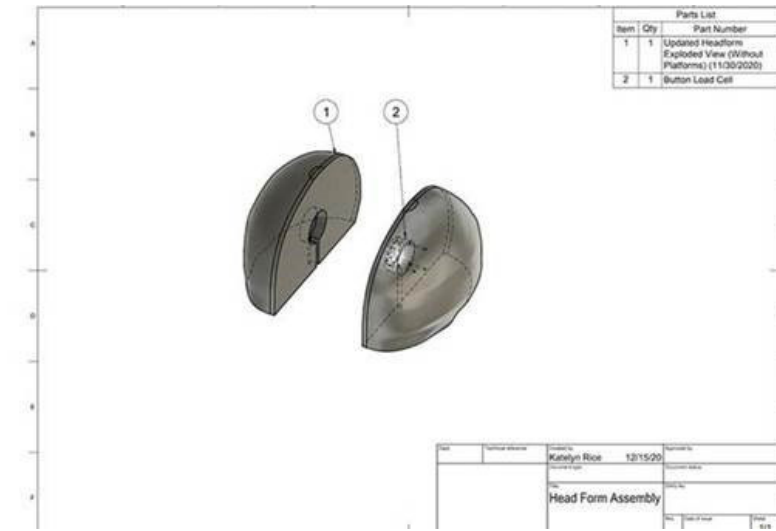
University of Kentucky students are working to develop a helmet testing method and collect data that will hopefully serve as the start of a crushing-safety standard for equestrian helmets.

CRUSHING ACCIDENTS, WHILE RARE, OCCUR WHEN THE RIDER FALLS FROM THE HORSE AND THE HORSE EITHER STEPS ON OR FALLS ON TOP OF THE RIDER'S HEAD. WHILE EQUESTRIAN HELMETS CERTIFIED ACCORDING TO ASTM STANDARDS PROTECT RIDERS IN A VARIETY OF WAYS, THERE IS NO TEST IN PLACE TO EVALUATE A HELMET'S CRUSH RESISTANCE.

Students Stuart Nicholas from Covington, Sam Gilbert from Corbin and Katelyn Rice from Shelbyville are working to develop a helmet testing method as part of their senior capstone design course in the UK Department of Biosystems and Agricultural Engineering. All are interested in pursuing careers in the medical industry after graduation. Their instructors are Alicia Modenbach, PhD, PE, lecturer and student services coordinator, and Mick Peterson, PhD, professor, respectively, in the UK College of Agriculture, Food and Environment. Stephanie Bonin, PhD, PE, senior biomedical engineer with MEA Forensic in Laguna Hills, California, is advising them.

"Biosystems engineering blends biology with engineering principles to design solutions for living systems," Modenbach said. "Many of our students have an interest in medical school, veterinary school or other biomedical applications of engineering. It is invaluable to them to have the opportunity to work closely with a local industry like the equestrian industry. Projects like this one integrates engineering design with many of their career interests."

Nicholas said he was interested in the project, because it is related



THE STUDENTS' HEADFORM DESIGN AS OF DEC. 1. THE HEADFORM WILL FIT INTO A HELMET TO TEST THE HELMET'S CRUSH RESISTANCE. DRAWING BY KATELYN RICE, UK STUDENT.

to biomedical engineering, which is his minor and the field of study he plans to pursue in graduate school.

"Since the project requires researching biological properties of the head and skull to develop an accurate model headform, it is an engineering problem that relates to the human body," he said.

To help fund their project, the students applied for and received a project award from ASTM International, which develops safety standards for materials, products, systems and services.

Students began working on the project during the fall semester by researching the frequency and severity of equestrian crushing accidents, designing a headform to fit into a helmet for testing, and developing sensors to record lateral forces applied to the headform. The students are building and testing their headform design during the spring semester.

"Helmet standards need to rely on both field and laboratory test data. In order to develop a compression test protocol and acceptance criteria, we need to test helmets at load rates that represent crushing scenarios in the

field while recording headform forces. The headform forces will be compared to published injury tolerance data," said Bonin, who is also chair of the ASTM Equestrian Helmet Committee.

"Our goal for the project will be to have a functioning headform equipped for providing real-time force data when tested on equestrian helmets and to develop a testing protocol that is based on actual injuries riders may face during equestrian events, such as getting crushed by a horse after a fall," Nicholas said. "This project is the first step in the creation of an ASTM standard, as it will take many more years and research projects to reach this goal, but we hope our project shows the need for a lateral crushing standard for equestrian helmets."

The students will present the results of their project at the end of the semester and submit a final report to ASTM.

| *Source: March 8 UK College of Agriculture, Food and Environment news release. Katie Pratt is an agricultural communications specialist.*

CONTROL EFFORTS FOR POISON HEMLOCK AND BUTTERCUPS BEGIN IN LATE WINTER

Late winter is one of the best times of the year to assess fields and fencerows for presence of cool-season weeds. Further, the preferred time to implement control tactics can often be in March as daytime air temperatures begin to rise and are maintained above 55F. This is when cool-season weeds are younger and begin their active vegetative growth before initiating flowers later in the spring. Winter annual and biennial weeds typically germinate from seed in the fall and produce flowers during the spring.

Poison hemlock is easily recognized throughout the winter and early spring. Classified as a biennial, it often grows as a winter annual in Kentucky, particularly plants that germinate during the previous fall. Poison hemlock plants form rosettes that remain green throughout the winter in a somewhat semi-dormant stage (*Figure 1*). These young rosettes are often found in areas where poison hemlock was present the previous year, particularly along fence rows and other isolated areas. Younger plants can be identified by their fern-like leaves with leaf petioles that have purple spotting and no hairs. After resuming active growth in late winter, they form larger rosettes. Later flower stalks elongate during the spring, producing clusters of white flowers in June. Mature plants can grow up to 6 to 9 feet tall (*Figure 2*).

The best time for control using herbicides is generally when plants are in the younger rosette stages of growth in late February and early March. Herbicide products containing 2,4-D, dicamba+2,4-D (Weedmaster, Brash, Rifle-D, etc.), and aminopyralid (GrazonNext,

DuraCor) are the preferred choices for obtaining effective control.

Effectiveness of chemical control can decrease as plants begin to elongate and become more mature. Poison hemlock plants can be toxic to animals; therefore, when using herbicidal control methods on larger plants, it is important to remove animals from treated areas. Animals are more likely to graze poison hemlock plants following herbicide treatment than before. On mature plants mechanical methods such as mowing can be an alternative control method if infested areas are accessible. Mowing and other mechanical control efforts should be done after flower stalks elongate but before plants begin to flower.

Another common weed we observe during the spring in grazed pasture fields are buttercups (*Figure 3*). Various species of buttercup (*Ranunculus* spp.) are likely to be found in Kentucky. These include Bulbous, Creeping, Hispid, Tall and Smallflower buttercup. Although their leaf shape, flowers and other characteristics may vary, many buttercup plants can be noticed by their



FIGURE 1. POISON HEMLOCK ROSETTE. PHOTO COURTESY UK COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT.

yellow flowers, commonly with five waxy-like petals. Like other winter annual weeds, buttercup often emerge in the fall, but they can also germinate in late winter and early spring. The peak of the flowering period usually occurs in April but may persist into May. When flowers are observed, new seed may already be in development on the flower stalks.

Buttercup is more frequently



FIGURE 2. MATURE POISON HEMLOCK ROSETTE. PHOTO COURTESY UK COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT.



FIGURE 3. BUTTERCUP. PHOTO COURTESY UK COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT.

found in fields or field areas that are utilized or heavily grazed in the fall and winter months. This results in thin, bare areas throughout the field, creating an environment where buttercup seed can readily germinate, and seedling plants can thrive. Therefore, one long-term control strategy involves utilizing management practices which help promote growth of desirable forage species and minimize bare areas. Inter-seeding

more desirable forage species may be another practice to consider. This is not always practical in some fields that are essential for winter feeding.

In the short-term, herbicide treatment in early spring is an option. Herbicide products that contain 2,4-D, or other broadleaf type pasture herbicides are generally effective on most buttercup species. To be most effective, herbicide treatment should be

completed when plants are in the vegetative stages of growth before flowers develop and produce new seed. Hence, herbicide applications should normally occur by late March. Treatments after flowering offer little benefit since buttercup plants are already producing new seed and plants die back naturally by late spring and will not be present the remainder of the year.

If you do see developing cool-season weed problems as we transition from late winter into early spring, you may need to take action soon to begin to correct these problems. In general, herbicide products that contain 2,4-D are usually effective on younger rosettes of poison hemlock, biennial thistles and buttercups. Another course of action in the spring is a “wait and see” approach before implementing a control tactic. Yet, keep in mind that smaller weeds are easier to control using herbicide treatments than after they increase in size and become more mature.

| *Source: March 1 Kentucky Forage News. J.D. Green, PhD, extension weed specialist in the UK Department of Plant and Soil Sciences, provided this information.*

POST-DOC STUDENT SPOTLIGHT: CAROLINE LOOS



Caroline Loos is a post-doctoral scholar in the laboratory of Kristine Urschel, PhD, associate professor in the Department of Animal and Food Sciences in the University of Kentucky’s College of Agriculture, Food and Environment. She found time in her busy schedule to answer questions about her research program at UK, and her experiences in the United States.

You are from Belgium. Can you tell us how you ended up in Kentucky?

I was born and raised in Belgium and have been working with horses and riding my entire life. After receiving a bachelor's degree in animal sciences and a post-graduate degree in animal rehabilitation and sports coaching from Vives University in Belgium, I came to Lexington in 2010 to work at an equine rehabilitation facility. What was supposed to be a six-month internship in completion of my post-graduate degree became a decade of working in various sectors of the equine industry here in the Bluegrass State.

Can you tell us more of what your life in Belgium was like, and more about your involvement with horses there?

Although no one else in my family had anything to do with horses, they have been my passion for as long as I can remember. I have been riding since I was 3 years old and, in contrast to what most people around me believed, I was successful in turning that love for horses into a career as well. Throughout my childhood I rode at the local Pony Clubs and worked with privately owned horses and pretty much participated in any equine-related event I could get to. I dedicated all my vacations to horse camps and, later, horse packing trips where I spent weeks in the Pyrenees Mountains and galloping through the Sahara Desert.

Of all the equine sport disci-



plines, I enjoy being out in nature with my horses the most; there is simply nothing like riding your horse toward the horizon to explore the world. In search of that unique combination between competition and trail riding, I started riding endurance in my 20s and absolutely fell in love with the sport. At that point, I was working at an Arabian horse breeding farm and I fell in love with the Arabian horse, which naturally excels in this sport. I competed at low level

competitions in Belgium and was lucky to quickly make friends in Kentucky who also competed in endurance, which allowed me to ride in several competitions in the U.S.

How did you end up as a UK graduate student?

After working in various sectors of the equine industry in Kentucky, I was looking for a change, something that would allow me to really contribute to equine welfare and performance. So, in 2014, I decided to go back to school and enrolled as a graduate student at the University of Kentucky, where my research focused on investigating how insulin resistance affected the cellular mechanisms that regulate muscle protein synthesis in horses.

I also developed a strong interest in the relationship between dietary protein and insulin metabolism particularly in horses with metabolic problems. Most research up until this point has focused on the risks of carbohydrates in these horses, but in some of my work I showed that a large protein meal also causes significant hyperinsulinemia in horses with equine metabolic syndrome. This indicates there are other nutritional factors we should take into consideration when managing these types of horses.

After receiving my PhD in equine science and nutrition in May 2018, I received an opportunity to stay at UK, where I have been working as a post-doctoral scholar for the last two years, continuing my research in nutrition,



endocrinology and physiology. My program continues to focus on optimizing protein feeding in relation to muscle development and to further elucidate how protein metabolism might be affected by metabolic diseases.

Additional projects I am currently working on involve looking at the effects of ergot alkaloids as well as essential oils on glucose and insulin metabolism in healthy horses and horses with insulin dysregulation. I have been very fortunate to work closely with equine industry partners, who have supported some of my research and allowed me to gain different experiences outside of academia.

How did you end up in Dr. Urschel's lab?

As my interests in equine health are very broad, I interviewed for positions in many different labs at universities across the country when I was looking to start my graduate school program. At UK, I interviewed both at the Gluck Center as well as the Animal Science Department, but in the end, I found

my match in Dr. Urschel's lab.

While I love nutrition, I am also very interested in endocrinology and physiology and how metabolic disease affects health and performance. With Dr. Urschel's expertise in muscle physiology and her interest in how muscle metabolism is impacted by both nutritional as disease factors, I found a perfect fit.

I also immediately noticed the dynamic, positive and enthusiastic atmosphere she created in her lab and I got along great with the other graduate students and technicians. More than anything else, your lab environment and advisor are the most important part of a successful completion of your graduate school program. Through Dr. Urschel's lab, I have met the most extraordinary people that have become my closest friends and have accomplished more than I could have ever imagined.

What is a typical day in you lab?

As for everyone, things have changed a bit with the pandemic, and I have mostly worked from home in the last year. However, the typical day very much depends on what is going on at certain times of the year. When we are doing active research, most of our days are spent at the horse unit taking care of the research horses and collecting samples (my favorite part of the job).

Once the animal work of projects is completed, I typically work in the lab most of the day analyzing the samples and doing data analysis.

Once this second phase is completed, then it comes down to writing everything up into a manuscript for publication. So, there is a lot of variation in my days, which I like very much. There are also a lot of opportunities to work on other people's research projects, which I highly recommend doing as a graduate student.

For example, I have helped with research at the Gluck Equine Research Center, at the medical center and at the beef unit. The world truly lies at your feet and doors open easily for graduate students, so I grabbed every opportunity I could to broaden my skill set, knowledge and, more importantly, building a wide network with people in many different fields as you never know where you will end up.

What's your favorite thing about Lexington or its horse world? How is it different from what you'd experience in Belgium?

For some reason I have always been drawn to the U.S. Somehow it felt always like a second home. There is certainly a lot more space here than there is in Belgium and a lot of undisturbed nature, even within a short distance of the city.

Since my favorite thing to do is exploring the country on horseback, America is truly a good place to be. Lexington in particular is such a unique place, unlike anywhere I've ever been. It lives and breathes horse, and I would say is a true paradise for any horse lover.

When I just arrived here in 2010, I would just sit in a coffee shop and listen to people's conversations, 90% of which had something to do with horses. And I remember that just made me smile and I thought to myself, "I am home."

While there is a very big equine industry in Belgium as well, in particular in breeding and competing sport horses in jumping disciplines, it isn't quite as tangible as it is here in Lexington. Whether you drive through the rolling hills and stunning farms filled with horses left and right or listen to the thundering hoofs of Thoroughbreds racing on the Keeneland racetrack, this city truly is the horse capitol of the world.

Most of my friends are also



involved with horses, so I have been lucky to be able to ride regularly since I got here. I recently started leasing a horse as well, an Anglo-Arabian (of course), which I'm very excited about. We competed in our first endurance ride last fall and am looking forward for the new season this year. If there is one thing I've come to realize during this pandemic, it is that you need to make time to do the things you love the most. While graduate school completely took over my life for a few years, I am happy now to finally get back into the sport I love doing the most.

What are your future plans?

I keep my doors open and seize opportunities as they come. I intend to finish my postdoc this year and hopefully find a position as a scientist/nutritionist in the equine industry. I would like to stay involved in research but also have an educational role in translating the science into practical information for horse owners, so we can continue to work towards improving health and performance of the animals we love so dearly.

| Karin Pekarchik, MS, senior extension associate for distance learning and founder of the UK Female Equestrian Health and Wellness Community of Practice, provided this information.

BILLIONS OF CICADAS WILL RETURN TO KENTUCKY IN LATE SPRING

This May and June, billions of 17-year periodical cicadas will emerge from the ground all across Kentucky, but don't worry. They will mostly be a noisy irritation, said a University of Kentucky College of Agriculture, Food and Environment entomologist.

"Periodical cicadas are not a pest necessarily, especially of people," said Jonathan Larson, PhD, UK extension entomologist. "They are not going to bite us. They are not going to attack us. They are not inherently toxic to pets. There can be some annoyance with the noise they produce, especially if you are standing right next to them. It's like standing next to a jet airplane."

The emerging cicadas this spring are part of Brood X, which is one of the largest groups of cicadas in the U.S. In addition to Kentucky, these cicadas will be present in Michigan, Illinois, Indiana, Ohio, New York, Georgia, Tennessee, North Carolina, Virginia, West Virginia, Pennsylvania, Maryland, New Jersey and Delaware.

While cicadas will be present



PRESERVED SPECIMENS SHOW THE DIFFERENCE BETWEEN THE ANNUAL CICADAS (TOP) AND THE PERIODICAL CICADAS (BOTTOM). THE PERIODICAL CICADAS ARE THE ONES THAT WILL BE IN KENTUCKY THIS SPRING. PHOTO BY JONATHAN LARSON, UK EXTENSION ENTOMOLOGIST.

throughout Kentucky, counties along the Ohio River, state parks and forested areas are expected to see the biggest numbers.

"Normally we see the annual cicadas, which are green and black, but the cicadas emerging this summer are a different species. They are black with red eyes and orange marks on their wings," Larson said. "It will be a unique

experience. The trees will be very loud this spring. People should get out and try to enjoy them while they are here."

Kentuckians who have young trees, especially newly transplanted ones that are potential hosts to the bugs, should prepare to protect their trees. Host trees include young oaks and fruit trees.

"Those can be damaged as the female cicadas lay their eggs in their branches," Larson said. "Getting some netting with holes that are less than one-half-inch wide and wrapping it around the young trees for about six weeks while the insects are out will keep those females from laying their eggs on them."

When the cicadas emerge from the ground as nymphs, they will molt and leave behind a brittle exoskeleton.

| *Source: UK College of Agriculture, Food and Environment news release. Katie Pratt is an agricultural communications specialist.*

FERTILIZER NITROGEN SOURCES FOR FORAGE PRODUCTION



PHOTO COURTESY DR. JIMMY HENNING.

As the 2021 forage production season approaches, nitrogen (N) management will be a key component of soil fertility programs for pastures and hayfields. The following is an update on the fertilizer N sources that can be used to increase both yield and forage quality and inhibitors/stabilizers that can be used to prevent N losses.

Fall and early spring applied dry bulk fertilizer blends intended to provide potash (K), phosphate (P) and sulfur (S) will likely contain N, due to use of dry fertilizer materials like monoammonium phosphate (MAP, 11-52-0), diammonium phosphate (DAP, 18-46-0) and ammonium sulfate (AS, 21-0-0-24S). These fertilizer N salts dissolve readily in moist soil

and are excellent N sources since ammonium-N is plant available, not often subject to N loss and does not need N loss protection. However, due to high cost per pound of N, these are not normally viewed as N sources.

Sole N sources for forage are marketed in both solid and liquid forms. Although any of these can be used, regardless the time-of-year, urea (46-0-0) and urea-ammonium nitrate solutions (UAN, 28-30- or 32-0-0) are most commonly used. More expensive and harder to purchase, ammonium nitrate (AN, 34-0-0) – half the N is ammonium-N and half is nitrate-N – is another solid fertilizer salt behaving similarly to MAP, DAP and AS.

Urea quickly dissolves in the soil and then hydrolyzes to form ammonium-N. Urea soil behavior is complicated by the possibility of ammonia gas volatilization losses due either to an increasing soil pH (up to pH 9) near the dissolving urea granule or to the near-granule presence of urease (more likely in Kentucky's pasture and hay fields). Urease, an enzyme widely found on both living vegetation and dead crop residues, catalyzes ammonia volatilization during urea hydrolysis. Under certain conditions, urease can cause a large fraction (up to 35%) of urea-N to be lost. Factors affecting the amount of loss are soil temperature (warm) and moisture (moist but drying), wind (a nice breeze), presence of vegetative/residue cover/urease and a soil pH greater than 6.5.

In UAN solutions, half the N is dissolved urea, a quarter is ammonium-N and a quarter is nitrate-N (from the dissolved ammonium nitrate). UAN is compatible with other liquid nutrient sources (ammonium polyphosphate, APP, 10-34-0; ammonium thiosulfate, ATS, 12-0-0-26S) and certain herbicides (weed and feed) which accounts for increasing UAN use. UAN-urea is subject to volatilization



PHOTO COURTESY DR. JIMMY HENNING.

loss as discussed for urea, above. UAN volatilization loss is smaller than that from urea, per pound of applied N, because just half the UAN-N is from urea.

Volatilization loss can be avoided/minimized, without inhibitors, using certain timing, rate, or N source management practices. Urea or UAN applied before May 1, when soils are generally moist and cooler, will generally experience little volatilization loss. After May 1, apply urea or UAN when: a) rainfall (0.25 inch or more) incorporation is expected within two-four days; and/or b) there is less forage canopy, resulting in increased fertilizer soil contact. If the urea or UAN application seems likely to suffer volatilization loss, consider a) applying 15-25% more N per acre, b) changing the chosen N source or c) modifying the urea or UAN by asking the fertilizer retailer to add a volatilization inhibitor.

It is important to note that there are two types of N loss inhibitors, nitrification inhibitors and urease/volatilization inhibitors – unrelated to each other and helpful in two very different situations. Some commercial products combine both types but should not be bought when only volatilization loss is anticipated. In forage production,

a need for nitrification inhibition is unusual. Effective urease/volatilization inhibitor active ingredients include: N-(n-butyl) thiophosphoric triamide (NBPT); N-(n-propyl) thiophosphoric acid triamide (NPPT); Duromide (undetailed derivative of NBPT); and, less effective, ammonium thiosulfate (ATS). In many situations, NBPT alone will control volatilization, but some commercial products combine NBPT with other urease inhibitors (especially NPPT and Duromide) to extend/improve volatilization inhibition. For a more information on nitrogen sources and volatilization inhibitors, contact your local extension office.

| *Source: March 1 Kentucky Forage News. John Grove, PhD, professor, and Chris Teutsch, PhD, extension associate professor, both in the Department of Plant and Soil Sciences, provided this information.*

UK EQUINE RESEARCH SHOWCASE RECAP

IMPACTS OF COVID-19 ON KENTUCKY'S EQUINE MARKETS

Jill Stowe, PhD, associate professor in the University of Kentucky Department of Agricultural Economics, provided a high-level overview on what is brewing in equine markets for her presentation at the 10th Annual UK Equine Research Showcase. She reviewed her research on the impact of COVID-19 on Kentucky's equine markets and the 2022 Kentucky Equine Survey.

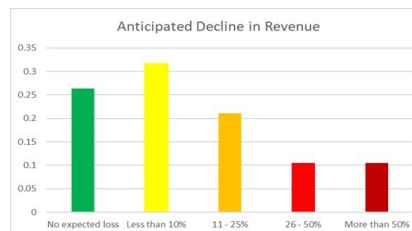
Stowe's research on Kentucky equine markets amidst COVID-19 was conducted with assistance from colleagues, Robert Coleman, PhD, equine extension specialist in the Department of Animal and Food Sciences, and student Jenna Bryant.

"The main question we are asking is how have restrictions from COVID-19 affected Kentucky's equine operations," Stowe said.

To begin studying COVID-19's impact on equine markets, the research group surveyed stallion operations, competition managers and equine boarding, training and lesson operations in Kentucky. For stallion operations, more than 50% reported no unexpected decline in the number of mares bred with the exception of a decline in sires with lower stud fees. A total of 80% reported that no new breeding incentives were offered and 93% reported there was little to no increase in operating costs due to COVID-19 restrictions.

Boarding, training and lesson operation survey results indicated a stronger impact from COVID-19, with 89% of survey participants reporting the need to make initial changes to continue

to operate under pandemic restrictions. About 32% initially closed, with the exception of essential employees, until they were able to find ways to operate safely under the new guidelines.



STOWE'S RESEARCH ON THE ANTICIPATED DECLINE IN REVENUE FOR BOARDING, TRAINING AND LESSON OPERATIONS.

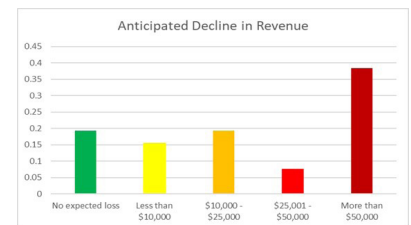
Survey results also indicated that few respondents utilized the Paycheck Protection Program or filed for unemployment. Furthermore, 42% of operations reported a loss in clients due to operational changes or clients' inability to pay their bills; however, a handful of respondents actually reported increased business since riding lessons were one of the few permissible activities early on.

UNFORTUNATELY, SURVEY RESULTS SHOWED THAT COMPETITION ENTERPRISES LIKELY SUFFERED THE MOST AS A RESULT OF THE COVID-19 PANDEMIC WITH THE CANCELLATION OF 67 COMPETITIONS. OUT OF THOSE, ONLY 22 COMPETITIONS WERE RESCHEDULED.

Competition managers had to make tremendous adaptations to be able to run under COVID-19 restrictions, which had a major impact on the number of shows that

were able to continue. The one silver lining, Stowe said, was that there was an increase in competition participation for the events that were still able to run.

"THIS SEGMENT OF THE INDUSTRY, WE ARE GOING TO FIND, WAS HIT HARDER AND MIGHT NEED SOME HELP GETTING BACK ON THEIR FEET," STOWE SAID.



STOWE SHOWED THE HARSH IMPACT ON EQUINE COMPETITIONS WITH AN OVERALL ANTICIPATED DECLINE IN REVENUE OF MORE THAN \$50,000.

Stowe then transitioned to the 2022 Kentucky Equine Survey. A comprehensive equine survey was last conducted by UK in 2012. Stowe is interested in conducting a new comprehensive survey to provide both current information and an analysis of changes that have occurred over the 10-year period. The data generated provides important information about the economic impact and reach of Kentucky's equine industry. The ability to conduct a survey in 2022 is directly dependent on support from the industry financially and through advocacy.

"We would like to see this

survey happen because I think it is really important for the long-run sustainability of the industry,” Stowe said.

If you are interested in learning more about the 2022 Kentucky Equine Survey initiative, contact Stowe at jill.stowe@uky.edu. Learn more about the 2012 Kentucky Equine Survey [here](#).

| *Erin DesNoyers is operations coordinator for UK Ag Equine Programs.*

Benefits of Kentucky Equine Survey

- Support Kentucky’s equine economic cluster
- Provide current information to the state’s policy makers
- Support disease surveillance efforts by the UKVDL
- Facilitate business owners and entrepreneurs in business planning and obtaining loans
- Stimulate research and extension programming grants
- Facilitate grants for equine-related non-profits
- Inform county extension agents
- Support lobbying efforts
- Capture the impact on broader range of ancillary businesses (feed, fencing, etc.) in the state



UK Agricultural Economics
agecon.ca.uky.edu



UK EQUINE RESEARCH SHOWCASE RECAP

BIOLOGICAL PASSPORT OVERVIEW

The University of Kentucky hosted the fourth and final session of its Equine Research Showcase Feb. 9. Presenting sponsors included BET, Kentucky Performance Products, McCauley's, Merck, Rood & Riddle Equine Hospital and Tribute Equine Nutrition. The session included several 10-minute mini presentations about hot topics in the area of equine research.

Scott Stanley, PhD, professor in the Gluck Equine Research Center, spoke about the Equine Biological Passport project ongoing in his laboratory. It's a project that has been under way for several years, but is based now in Kentucky after Stanley relocated to UK a few years ago.

The Equine Biological Passport uses protein biomarkers similar to human health monitoring, but as a tool for anti-doping in the horse industry.

The Equine Biological Passport is a drug deterrence process used for biological measurement in individual horses over a period of time. By repeated longitudinal assessments, normal values for the biomarkers in that specific horse are established. If doping techniques are used, altered biomarker levels are evident in the report. Over time, this may lead to even stronger deterrence of illicit practices in horse racing.

"From a research perspective, if a horse is administered a new medication, or a medication in a particular drug class (steroid, painkiller, etc.) we can monitor that by either targeting the drug or by targeting the animal's system," Stanley said.

According to Stanley, bio-



PHOTO COURTESY STONESTREET FARM.

logical changes are evident after medication administration occurs, and regardless of the amount of change, as long as these biological indicators move from their normal state, one can follow the changes effectively.

The main elements of the Equine Biological Passport are steroidomics, proteomics, genomics and bioinformatics. Stanley described the testing as straightforward but very analytical. Recently, his group has used this process in an administration study of Nitrotain, which is a very short acting anabolic steroid.

"We've collected samples over time, separated and analyzed those by a method known as protein depletion, which is removing the unnecessary proteins. We then do a very extensive analysis that includes a high-end analytical tool, called an Orbitrap™," Stanley said.

From there, the data gets processed through software called Peaks and Proteo Discoverers, allowing the design of specific experiments that can be utilized to identify proteins to determine if there has been a physiological

change due to the administration of a prohibited substance.

Future short-term goals for the Equine Biological Passport include improving analytical methodologies, conducting investigations that focus on emerging threats (SARMs, Syntetic EPO, BoTox®, etc.), and incorporating a wider range of biomarkers. Some longer-term goals include validating approaches and ability to detect abuse, and incorporating the entire test into routine regulatory drug testing strategies.

| *Sabrina Jacobs, a senior majoring in equine science and management and minoring in wildlife biology and management, is a communications and student relations intern with UK Ag Equine Programs.*

MAINTENANCE QUALITY SYSTEM'S IMPORTANCE IN RACETRACK SAFETY

The University of Kentucky hosted the fourth and final session of its Equine Research Showcase Feb. 9. Presenting sponsors included BET, Kentucky Performance Products, McCauley's, Merck, Rood & Riddle Equine Hospital and Tribute Equine Nutrition. The session included several 10-minute mini presentations about hot topics in the area of equine research.

During one of those talks, Mick Peterson, PhD, professor in UK's Department of Biosystems and Agricultural Engineering, gave a short talk on the Maintenance Quality System (MQS). The MQS was developed for the evaluation of Thoroughbred racetracks with some aspects having been adapted by his collaborators to evaluate other equine performance surfaces. The MQS has three phases analogous to the monitoring procedures in commercial airlines: flight certification, pre-flight inspection and a black box data recorder.

"We're really borrowing the ideas that they use in an aircraft, because like an aircraft, the racing surface is a safety critical system that you use day in and day out. It is expected to be perfect every day," Peterson said.

The MQS is managed by an independent non-profit laboratory which was also founded by Peterson, the Racing Surfaces Testing Laboratory (RSTL). Peterson described the goal of his lab at UK as both developing automation to improve the quality of the data collected and to learn how to respond to the data collected in order to improve track safety for the benefit



PHOTO COURTESY RACING SURFACES TESTING LABORATORY.

of the horse and rider.

"There was a significant gift from The Jockey Club to RSTL that has focused on the pre-flight inspection. The pre-flight inspection stage in the process reduces variability between tracks, which we've shown to be critical," Peterson said.

Another research goal Peterson described is the need for a better black box data recorder, which will include real time data collected from the track and depicted on a mesh network of track coordinates.

When describing the MQS, Peterson broke it down into three stages. The first is design documentation and setup. For example, some equipment has different names in different locations. There is also a need to document a target composition for the tracks that has been developed over time and experience. Additionally, the geometry of the track is critically important as well, because if done

incorrectly, the transition horses have to make from the turns to the straights can be dangerous as they change leads. The tracks also should optimally have a meteorological grade weather monitoring station at the track.

Peterson described what is included in the documentation when a track is evaluated, including factors like turf species, moisture targets and consistency, as well as standard operating procedures for equipment that goes on all three surfaces, dirt, turf and synthetic. "This is the flight certification, before we think a track should be used, this should be documented so that everyone who goes to the track or works at the track understands the basic approach to maintenance of the surface," Peterson said.

Peterson also explained that the racing surface seasonal test consists of ground penetrating radar to inspect the base, biomechanical surface testing to make sure the

mechanical properties of the track are similar and overall testing composition to compare it to those targets that are set in phase one. He compared this to the preflight inspection, and if tracks do it early enough before the race meet they have enough time to fix any issues that are needed to help make the track both more consistent for the particular surface and similar to other tracks where horses may ship in from.

“This part of the Maintenance Quality System has been dramatically altered by The Jockey Club gift. It was announced at the 2019 Jockey Club Round Table and consists of expensive new equipment for testing the track and an updated database. The gift allows us to position equipment around the United States and be much more efficient in our pre-race meet testing,” Peterson said.

The third stage of the MQS is daily track monitoring and measurements. This stage includes

logging the equipment that goes out on the track, as well as measuring the cushion depth and moisture. He explained that this is one of the most difficult aspects, but also one of the most important parts of the MQS, comparing it to the dashboard of the aircraft, or the “black box,” as everything that happens is recorded and can be looked back upon.

Peterson described the measurement of moisture and cushion depth as two of the most basic, but also the most time-consuming, parameters. Many of the leading tracks have been willing to commit the resources to do these tests, including Keeneland, NYRA tracks, Del Mar, Santa Anita, Churchill Downs and Oaklawn. It is a large commitment for tracks to commit labor to this daily measurement and the human element can compromise data quality. There is a need for automation of this task but there is a lot of equipment on the track and the racetrack covers a lot of area.

“Our newest approach to this,

then, is using a mesh network. This is the type of network that is used in the industrial internet of things, and the advantage of this is that it allows communication between equipment and nodes located on the track. The goal is to put low-cost sensors at different locations and on the equipment for tracking and monitoring. This will give us the ability for real time speed monitoring of the equipment, and most importantly, real time moisture sensing,” Peterson said.

Testing of the sensors will be ongoing this spring both at Keeneland and the NTRA Equine Surfaces and Safety Laboratory on the UK campus.

| *Sabrina Jacobs, a senior majoring in equine science and management and minoring in wildlife biology and management, is a communications and student relations intern with UK Ag Equine Programs.*

UK EQUINE RESEARCH SHOWCASE RECAP

RESEARCHING mRNA EXPRESSION IN THOROUGHBREDS WITH CATASTROPHIC RACING INJURIES

Allen Page, DVM, PhD, scientist and veterinarian at the University of Kentucky Gluck Equine Research Center, spoke about a recently published paper from his laboratory on the expression of select mRNA transcripts in Thoroughbreds at the fourth and final session of the virtual 10th annual UK Equine Research Showcase, comparing horses that suffered catastrophic racing injuries to controls. The event was sponsored by BET, Kentucky Performance Products, McCauley’s, Merck,

Rood & Riddle Equine Hospital and Tribute Equine Nutrition.

“In our lab, a lot of the work that we do relies on inflammatory gene expression analysis. What that means is that we are measuring differences in whole-blood messenger RNA (mRNA) markers,” Page said.

Page shared a couple different reasons his lab has opted to focus on mRNA. First, horses are not often a priority target for a lot of companies that make laboratory reagents, so being able to look at a wide variety of proteins is difficult.

Second, polymerase chain reaction (PCR) analysis of mRNA expression is highly sensitive and specific to the targets they are interested in. Lastly, changes in inflammatory mRNA markers take hours to be detectable. This means, for many transcript targets, that samples taken immediately post-injury likely reflect the pre-race status of the horse.

As a primer, Page described exercise-induced inflammation and how it occurs.

“Exercise-induced inflammation is a result of exercise-induced tissue damage. That can be mechanical damage to bone and soft tissue but can also be due to lactic acid and free radical accumulation. Regardless of how it happens, it ultimately results in the release of different damage-associated molecular patterns (DAMPs). DAMPs will work via a variety of different pathways, but all ultimately end up causing a release of pro-inflammatory cytokines,” Page said.

Exercise-induced inflammation is normal, he said, and is associated with the response of tissues to high level physical activity. It is important and necessary for tissue healing and repair, although it is thought that exaggerated inflammatory responses might be associated with injuries.

According to Page, there has been a lot of work done by others that show most catastrophic injuries occur either in limbs with pre-existing pathology/damage or in the opposite limb.

“Ours and others’ research have theorized that this damage may stimulate the production of specific biomarkers or proteins, or in our case, a non-specific inflammatory response that can be quantified and monitored,” Page said.

Describing his project, Page said the study’s hypothesis is that Thoroughbred racehorses that experience catastrophic (fatal) injuries while racing will have evidence of increased inflammation when compared to non-injured control horses.

“The goal of this project was to enroll 150 catastrophically injured horses and then enroll 300 post-race control horses that are matched to the injured horses. Those samples were collected post-race in the drug detection barn from horses that were in the same race as a catastrophically injured horse. We were also hoping to get around 700 pre-race controls that are sampled randomly to pro-



PHOTO COURTESY UK COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT.

vide us with an idea of what the general racing population looks like,” Page said.

This study took place from September 2017 to May 2020 in four different state jurisdictions as well as at one individual racetrack. A total of 904 samples were collected, representing 107 horses with catastrophic injuries, 205 post-race control samples, 374 pre-race control samples and 218 samples excluded from the study for various reasons.

“We had a lot of exclusion criteria for this study, so horses that maybe had a catastrophic injury but were known to have clipped heels or fallen over another horse weren’t included because we weren’t sure that they necessarily would have been injured in that race. Likewise, we excluded a number of our control samples because they didn’t race again within a certain amount of time, and we were concerned that maybe they had an underlying issue that wasn’t known to us. They may have had an injury that could have biased our data,” Page said.

The first thing Page wanted to do before examining the injuries was to look into the effects from racing on inflammation. Previous work on horses showed that inflammatory mRNA changes take

hours to manifest in response to exercise. That work has almost been exclusively done in horses either in short-distance race training or through work on treadmills, and not post-racing.

Page’s team used paired pre-race and post-race samples from the same horses to evaluate the effect of racing on 21 different mRNA markers. In the end, they had to eliminate 12 markers from analysis due to race-related effects. Out of the nine that were remaining, three markers showed promise in identifying horses at risk of catastrophic injury.

The three individual markers of interest were Insulin-like Growth Factor 1 (IGF-1), Matrix Metalloproteinase-2 (MMP2) and IL-1 Receptor Antagonist (IL1RN). Ultimately these three markers may provide economical, effective and non-invasive means of detecting horses at risk for catastrophic injuries.

| *Sabrina Jacobs, a senior majoring in equine science and management and minoring in wildlife biology and management, is a communications and student relations intern with UK Ag Equine Programs.*

UK EQUINE RESEARCH SHOWCASE RECAP

UK LAUNCHES THOROUGHBRED GENETIC DIVERSITY PROJECT



PHOTO COURTESY UK COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT.

The University of Kentucky hosted the fourth and final session of its Equine Research Showcase Feb. 9. Presenting sponsors included BET, Kentucky Performance Products, McCauley's, Merck, Rood & Riddle Equine Hospital and Tribute Equine Nutrition. The session included several 10-minute mini presentations about hot topics in the area of equine research.

Ernest Bailey, PhD, professor of equine genetics, Ted Kalbfleisch, PhD, associate professor and genome analysis expert, and Jessica Petersen, PhD, University of Nebraska Lincoln population genetics expert, presented a short discussion about their Thoroughbred Genetic Diversity Project. Kalbfleisch spoke on behalf of the team.

Identifying the number of genetic variants that exist in a population and at what frequency is key to understanding genetic diversity.

Kalbfleisch identified the role of genetic variation in a popula-

tion, and how it is essential to the health of the population. Pedigrees or similar methods are not accurate enough for genetic evaluation of this magnitude. A modern, more effective method is genomic sequencing, which has the ability to identify genetic variation and gene frequency.

Genomic sequencing is a cost-efficient way to understand nucleotide variation and many other details in a particular animal's genome.

"When looking at a population of animals, what you can do is assess the genetic variants that are present in those animals," Kalbfleisch said.

Via whole genome sequencing, the Thoroughbred Genetic Diversity Project will catalog all genetic differences that occur in Thoroughbreds at any frequency greater than 3%. After that, the animals will be analyzed to understand the frequency of each nucleotide variant individually within the population.

"The result of this, when we are

done, we will have anonymized genetic data that is published to public repositories," Kalbfleisch said. "Ultimately it is our hope that this data is used by breeders and farm managers."

This project is a start to documenting the presence of genetic diversity in Thoroughbreds in 2021. Genetic diversity changes over time, so this allows a point to reference and compare to in the future.

Currently, the team is looking for broodmare and older Thoroughbred horse blood samples for use in the project. Those who are interested should contact ebailey@uky.edu, jessica.petersen@unl.edu or ted.kalbfleisch@uky.edu for more information.

| *Sydney Carter, a junior majoring in equine science and management and minoring in journalism, is a communications and student relations intern with UK Ag Equine Programs.*

SMALL STRONGYLE RESISTANCE TO THE LAST EFFECTIVE CLASS OF DEWORMER

The University of Kentucky hosted the fourth and final session of its Equine Research Showcase Feb. 9. Presenting sponsors included BET, Kentucky Performance Products, McCauley's, Merck, Rood & Riddle Equine Hospital and Tribute Equine Nutrition. The session included several 10-minute mini presentations about hot topics in the area of equine research.

Martin Nielsen, DVM, Ph.D., Dipl. ACVM, Schlaikjer professor of equine infectious diseases in the Gluck Equine Research Center, spoke about current data showing resistance among cyathostomins (small strongyles) to the three main groups of anthelmintic (anti-parasitic) drugs.

"The small strongyle parasite, which is the type of parasite that all horses get, is the primary parasite category, the one that we are always deworming for," Nielsen said.

The first class of anthelmintic drugs introduced and administered to combat small strongyles was the benzimidazoles in the 1960s. Due to this class of drugs being used for the longest period of time, there is the highest level of wide-spread resistance in small strongyles today.

"It is very rare to find these products still working," Nielsen said.

Pyrantel salts began experiencing resistance in 1996 and Nielsen



STRONGYLE PARASITES. PHOTO COURTESY DR. MARTIN NIELSEN.

said it is also likely to find small strongyles resistant to Pyrantel dewormers today.

Macrocyclic lactones (ivermectin and moxidectin) are our "last resort," with good efficacy, but there have been some questionable early signs of emerging resistance reported, according to Nielsen. In 2020, routine data collected from a farm in Central Kentucky confirmed resistance to macrocyclic lactones among small strongyles.

Nielsen shared data showing that macrocyclic lactones were 100% effective against small strongyles in a group of U.S.-bred yearlings, but the same dewormers administered to a group of imported Irish bred yearlings failed to remove small strongyle parasites.

"There's no doubt, looking across this data, that we have clear-

cut, proven resistance to ivermectin in these imported parasites," Nielsen said.

"The problem is, if we have resistance to everything, what can we deworm with?" he said.

He described that the efficacy of moxidectin was also evaluated against the resistant parasites. Despite this drug being potentially more potent than ivermectin, it did not overcome the resistance and did not provide better efficacy.

Nielsen closed with a final note that ivermectin and moxidectin resistance is occurring in small strongyles. This case was

only discovered due to the meticulous testing procedures in place on this particular farm. Without regular testing of deworming efficacy, drug resistant parasites will go undetected, and farms will be left without opportunities to intervene before it is too late. Good parasite control starts and ends with testing the dewormers being used, and this has to be done every year.

| *Sydney Carter, a junior majoring in equine science and management and minoring in journalism, is a communications and student relations intern with UK Ag Equine Programs.*

UK EQUINE RESEARCH SHOWCASE RECAP

NEW UK COLLEGE OF PUBLIC HEALTH ONE HEALTH CERTIFICATE

On February 9, multiple speakers came together to discuss a wide variety of equine topics in rapid-fire succession for the final session of the virtual 10th Annual University of Kentucky Equine Research Showcase. Equine professionals and students had the opportunity to learn about a broad spectrum of hot topics from safety and welfare initiatives to publication resources to economic impacts on the equine industry as a result of COVID-19. Presenting sponsors for the Research Showcase event included BET, Kentucky Performance Products, McCauley's, Merck, Rood & Riddle Equine Hospital and Tribute Equine Nutrition.

Kimberly I. Tumlin, PhD, MS, MPH assistant professor in the Department of Epidemiology, College of Public Health and the Equestrian Athlete Initiative director for research for the Sports Medicine Research Institute, gave viewers an overview of a new UK certificate program named the One Health Certificate. This graduate certificate program is a culmination of efforts across campus which come together to fulfill the global One Health mission.

The One Health Certificate seeks to provide graduate students with additional training, whether their focus is veterinary medicine, human medicine, molecular biology, public health or other areas of graduate studies. Students in the program will evaluate complex issues among different ecosystem health levels and analyze how those groups interact to address the human-animal-environment triad

as well as how the One Health philosophy can assist in solving complex health challenges.

"What we see about One Health is that this systems approach and philosophy integrates all of these disciplines to look at both the infectious risk and non-infectious benefits this triad represents. The understanding of how these complex issues can be solved by a One Health team that is actually working in this triad interface is really core to what this certificate does," Tumlin said.

The program is fully online and the first course is slated to

the program which takes a look at social, cultural, economic and legal considerations to explain the One Health philosophy from veterinary, medical and agricultural perspectives.

"Horses will be a spotlight species throughout this course," Tumlin said.

The certificate program is designed to benefit not only those in agricultural and veterinary fields, but also those studying economics, law, public health and other socio-economic practices. Students interested in obtaining the One Health Certificate will need to be an established graduate student within the UK Graduate School and have been admitted to the College of Public Health. Students will begin the program by completing CPH 616 followed by electives chosen with verification by the director. Upon finishing the program, students will be required to complete a final reflection assignment.

Individuals interested in acquiring more information regarding the certificate program, may contact Erin Haynes, PhD, One Health Certificate Director at Erin.Haynes@uky.edu, or Tumlin, who will be the CPH 616 One Health Principles instructor at

Kimberly.Tumlin@uky.edu.



GRAPHIC ILLUSTRATING THE ONE HEALTH PHILOSOPHY AND TRIAD AMONG ECOSYSTEMS, PROVIDED BY DR. KIMBERLY TUMLIN. GRAPHIC FROM: [HTTPS://MEDIUM.COM/@SHWETACHELLUBOINA_74686/HOW-ONE-HEALTH-STRUCTURES-HUMAN-HEALTHCARE-863AF6AA14D1](https://medium.com/@shwetachelluboina_74686/how-one-health-structures-human-healthcare-863af6aa14d1).

commence in January 2022. Once completed, the program will provide nine credits as an add-on to the student's existing program of study. CPH 616, One Health Principles, is a required course of

| *Erin DesNoyers is operations coordinator for UK Ag Equine Programs.*

UPDATE ON 2020 NOCARDIOFORM PLACENTITIS

The University of Kentucky hosted the fourth and final session of its Equine Research Showcase Feb. 9. Presenting sponsors included BET, Kentucky Performance Products, McCauley's, Merck, Rood & Riddle Equine Hospital and Tribute Equine Nutrition. The session included several 10-minute mini presentations about hot topics in the area of equine research.

Barry Ball, DVM, PhD, Dipl. ACT, Albert G Clay Endowed Chair in Equine Reproduction at the Gluck Equine Research Center, presented an update about his research on Nocardioform Placentitis.

"It's not a new problem by any stretch, it is one that we have been dealing with episodically for over 30 years now in Central Kentucky," he said. "It is a relatively long known problem, but still a relatively poorly understood disease."

Nocardioform Placentitis was first diagnosed in Kentucky in 1986, with sporadic outbreaks since then. It has been reported in several other continents as well.

The disease is associated with gram-positive branching actinomycetes, which are soil-borne microorganisms.

According to Ball, late gestation, in months 10 or 11, is where the majority of lesions are seen. Abortions are often seen in the last trimester as well. This is characterized as a quiet inflammation of the placenta, without infection of the fetus. This makes Nocardioform Placentitis distinct from other forms of placentitis, where fetal infection and neonatal sepsis is common.

"The major problem we have with this disease is one of placental insufficiency. Enough of the placenta is damaged eventually that it interferes with the exchange



PHOTO COURTESY UK COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT.

across the placenta as far as nutrients, waste and oxygen for the fetus and we get stunted growth of the fetus."

There is a significant correlation between this disease and the weather the preceding August and September. When the previous autumn is warm and dry, like it was in 2019, there is a higher incidence of Nocardioform Placentitis.

Nocardioform Placentitis typically presents as a single abnormal area covered in a mucoid exudate. The disease is characterized by a distinct location at the base of the uterine horn, near its junction to the body of the uterus, whereas the location of ascending bacterial placentitis occurs near the cervical end of the placenta.

"Diagnosing these can be quite challenging. We have grown accustomed to measuring the combined thickness of the uterus and placenta with transrectal ultrasound; that's a fairly good technique for picking up ascending bacterial placentitis, but relatively few of the Nocardioform Placentitis cases will present with lesions in that area because it is further forward in the uterus, usually along the ventral body wall," Ball

said.

Mares with Nocardioform Placentitis may show early clinical signs such as premature mammary lactation or lack of vulvar discharge.

Data from the 2020 Nocardioform Placentitis outbreak shows that mares with the disease have a shorter gestational period. Foals born from affected mares were smaller with a greater chance of mortality. Larger lesions generally correlate with smaller foal size and an increased likelihood of foal mortality. Fortunately, mares with the disease do not show a reduction in fertility in subsequent breeding seasons.

Although many details of the pathogenesis of Nocardioform Placentitis remain unknown, research through the Gluck Equine Research Center continues. More information can be found [here](#).

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Suitable Spaces for Indoor Horse Activities

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Many horse owners need indoor arenas in which to work horses regardless of weather. These facilities might be at home or at a community location shared by many riders. This publication highlights some common characteristics and requirements of indoor arenas and details the minimum requirements. Many disciplines and activities may require additional investment in facilities, such as larger dimensions, more lighting, special footing, etc.

Dimensions

The minimum dimensions of indoor arenas should allow horses to perform normal motions without risk of injury to the horses or their riders (Table 1). The length of the arena allows the horses to progress in speed and the rider perform certain riding patterns. The width allows for the appropriate turning radius. The height is necessary for riding and potentially jumping. Recommended dimensions for an arena will vary with riding discipline, as Table 2 illustrates. The basic dimensions suggested for an indoor arena are:

- Minimal width: 50 to 60 feet
- Minimal length: 100 feet
- Minimal height: 16 feet to the lowest part of the ceiling or equipment hanging from a truss

Lights

Weather and time of day will limit the available sunlight, so artificial lighting is necessary to make the arena useable at all times. The objective is to have 30 to 40 foot candles (325-430 lux) at five feet above the arena floor. The light should be uniform and designed to ensure that there are no shadows or bright areas.

Footing

Footing consists of at least two layers. The base is a well-compacted, stable material that has been leveled. If the base cannot be developed out of the existing

Table 1. Suggested unobstructed dimensions for non-competitive indoor arena

Activity	Dimensions (preferred minimum, feet)		
	Width	Length	Height
Exercise, training, riding	50-60	100-130	14
Exercise, training, driving	60-100	100-130	14
Group riding	80	100-130	14
Jumping	80	100-130	16

Source: Wheeler et al. *Horse Facilities Handbook*

Table 2. Suggested arena dimensions for competitive indoor use

Activity	Dimensions (feet)
Barrel racing	150 x 200
Roping	150 x 300
Dressage (small arena) ¹	66 x 132
Dressage (standard arena) ¹	66 x 198
Show (standard) ²	120 x 240
Show (small) ²	110 x 220

Source: Wheeler et al. *Horse Facilities Handbook*

¹ United States Dressage Federation regulation size

² USEF suggested size



Figure 1. Uniform lighting in an indoor arena

subsoil, the added material should be at least six inches thick to handle the impact of the horses' hooves. The riding surface should be at least four inches thick to allow for traction and shock absorption.

Footing Maintenance

Footing will compact, break down, and move toward the outside of the arena over time. Choosing the proper implement, such as a drag, to maintain the footing depth, consistency, and integrity is critical. The operator of the drag must be trained to control depth and speed to create a level surface. Water or other additives are often applied for dust control. Proper equipment for appropriate distribution of water (adequate volume and consistency of application) should also be considered.

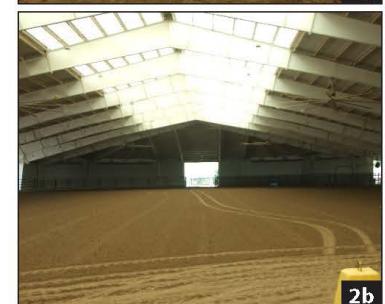


Figure 2. Footing in indoor arenas

Structure

Arenas must have access points for horses, humans, and equipment. Doors should be easily opened and properly placed to enhance accessibility to the building and the riding surface. The doors should be sized to accommodate any necessary equipment.

A wall or partial wall inside the roof support posts, fencing, or a knee wall



3a



3b

Figure 3. Drag (a) and water distribution system (b)

around the riding surface will keep horses contained to the appropriate area within the arena. It will also protect the posts. If the arena is designed to accommodate observers or non-horse related activities, it may also contain a separate area with a different surface than the footing described above.

Depending on the overall dimensions, the structure can be built out with either a wood or metal frame. Narrower arenas (60 feet wide or less) are usually built with wood framing; wider (greater than 80 feet wide) areas tend to be constructed with metal frames.

Ventilation

Good ventilation will provide a more comfortable environment for riding by moderating temperature and enhancing air quality. Openings along the peak of the roof will provide a way for stale air to exit. Sidewall openings, such as windows and doors, allow for air exchange. Fans can be included to improve air distribution and remove stagnant areas; however, unless the fan is placed in a wall or roofline, it will not enhance ventilation.

Meeting the minimum standards of size, lighting, and footing will allow you to design a space suitable for working with horses indoors when the weather is inclement.



4a



4b



4c



4d



4e

Figure 4. End wall door for equipment access to the indoor arena (a); knee wall around the indoor riding arena (b); wall separating the riding space and observation area (c); a wood framed indoor arena (d); and a steel framed indoor arena (e)



5a



5b



5c

Figure 5. Ventilating through a roof peak (a); large end wall openings for ventilation (b); and side wall windows for ventilation and high-volume low-speed fan for air movement (c)

For more information, see Wheeler et al. (2005), MWPS-60: Horse Facilities Handbook (Midwest Plan Service, Iowa State University, www.mwps.org).

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