June 2018

UCDAVIS
VETERINARY MEDICINE
Center for Equine Health

2018 CENTER FOR EQUINE HEALTH
Research Review

New Discoveries in Equine Health

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On the cover:

Cover artwork created by Chinese artist, Xu BeiHong.

Director's Message

Greetings!

It is my honor to share the 2018 Research Review focused on the research accomplishments of our esteemed faculty, graduate students and staff supported by the Center for Equine Health. The Center has a rich history of developing new knowledge that has transformed many aspects of the equine industry.

The Center for Equine Health supports a broad array of teaching, research and service activities essential to the UC Davis School of Veterinary Medicine and to the Center's mission. These include the on-going investigative studies on specific diseases, causes and treatment of equine injuries, new diagnostic tools and therapies, and educational efforts to train veterinary students and residents. The Center is dedicated to advancing the health, welfare, performance and care of horses. This includes operating the Contagious Equine Metritis (CEM) screening program for the State of California.

Since assuming the Gregory L. Ferraro Endowed Directorship in July, 2017, I have set a vision for the future of the Center that includes:

- adding a student internship program for first and second-year veterinary students
- expanding graduate student fellowship training opportunities
- enhancing outreach efforts to equine owners and industry representatives at all levels
- updating the CEM facilities for improved stall footing and drainage, a covered Equicizer, and enhanced footing in the riding arena and round pen
- continuing support of the teaching herd while providing top quality care of resident horses
- promoting the 40-year tradition of successful collaborations on equine projects across the school

This is an ambitious plan and it requires a strong partnership with the equine industry to put it into action. I value the generosity of the many donors who have made the Center's robust competitive research program a success. Thank you for your investment in the Center for Equine Health for the health and well-being of horses.

Carrie J. Finno, DVM, Ph.D., DACVIM
Director, Center for Equine Health

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CENTER FOR EQUINE HEALTH Awards

James M. Wilson Award

The James M. Wilson Award is given each year to an outstanding equine research publication authored by a graduate student or resident in the UC Davis School of Veterinary Medicine. The Center for Equine Health Scientific Committee judges the papers based on scientific merit, quality of writing and relevance to the equine industry. Dr. Wilson was a 1945 graduate of the Ohio State University College of Veterinary Medicine. He was a well-known and respected racetrack veterinarian in California and maintained a strong interest in equine research at UC Davis.

2015 James M. Wilson Award

The 2015 James M. Wilson Award was presented to Dr. Jennifer E. Symons for her work in equine musculoskeletal modeling and the simulation of dynamic movement on race surfaces, specifically for her publication, "Modeling equine race surface vertical mechanical behaviors in musculoskeletal modeling environment."

Researchers, veterinarians, and professionals within the horse industry are interested in racing and arena surfaces, for both injury prevention and performance. Jennifer Symon's research, under the supervision of Dr. Susan Stover and the mentorship of Dr. David Fhyrie, Dr. David Hawkins and Dr. Shrinivasa Upadhyaya, focused on developing a computer model of a virtual race surface that would mechanically behave like actual race surfaces. The model was validated by simulating virtual impacts of a mechanical track-testing device (TTD), designed to mimic a horse's hoof impacting the ground. Model results from virtual impacts were compared to experimental data collected from actual TTD impacts at racetracks. The model was able to reproduce forces and motions measured by the TTD on many different race surfaces, including harrowed and compacted, dirt and synthetic. Future research may use this surface model, combined with previously developed computer models of virtual horses, to improve understanding of racing and arena surface effects on horse hoof and limb motions. Computer modeling of arena and track surfaces is likely to significantly improve injury prevention efforts for equine athletes.

After graduating from Davis in 2007 with a BS in Mechanical Engineering, Jennifer focused her research into equine biomechanics, earning her masters in Biomedical Engineering in 2011, also at UC Davis. Symons completed her doctorate in Biomedical Engineering at UC Davis in 2015 and is now an assistant professor at the University of Portland. Dr. Symons is an avid horsewoman and is actively involved in sport horse jumping.

2016 James M. Wilson Award

Vanessa Dahl's research interests involve the equine foot and how shoeing can affect hoof movement and development of abnormal hoof conformations. By understanding how the application of a shoe might affect how the hoof behaves mechanically, she hopes to learn how the development of underrun heels that are prevalent in racehorses and associated with catastrophic injuries to the fetlock might be mitigated through management of the hoof and horseshoe design. She was honored with the 2016 James M. Wilson Award for her research publication "Effects of racetrack surface and nail placement on movement between heels of the hoof and horseshoes of racehorses."

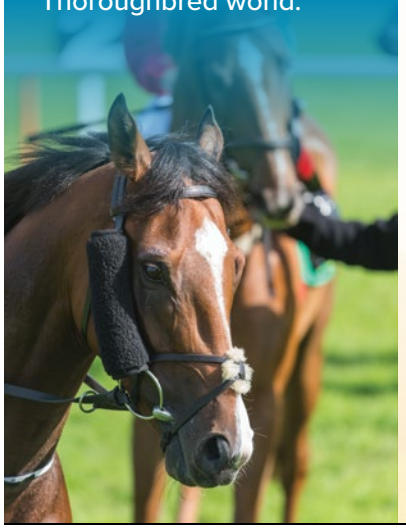
Dahl has been involved in the equine community for 35 years and participated in 4-H and the California State Horseman's Association's Horsemastership program, as well as having shown competitively in AQHA, USEF and ApHC events. She has worked as a professional braider for hunter/jumper horse shows for the past 15 years as well as been the Lead Teaching Assistant for the Animal Science Advanced Equine Production class in the Department of Animal Science at UC Davis. Furthermore, she has volunteered for a variety of veterinarians and hospitals including Pioneer Equine Hospital over the years.

Dahl arrived at UC Davis in 2008 and received her Bachelor's degree in Animal Science in 2011, her Master's in Animal Biology in 2014 and is currently working on her Ph.D. with Dr. Susan Stover in the J.D. Wheat Veterinary Orthopedic Laboratory. For her Master's thesis, she measured wear patterns that developed in horse shoes as a means to detect how the hoof behaves within the surface which led to a publication in 2016.

CENTER FOR EQUINE HEALTH Awards

Louis R. Rowan Fellowship

The Louis R. Rowan Fellowship, which is funded by the California Thoroughbred Foundation with financial assistance from the Oak Tree Racing Association, was established in memory of one of the California Thoroughbred Foundation's founders. In addition to being a noted racehorse owner and breeder, Rowen was active in many areas that benefitted people and horses in the Thoroughbred world.



2015 Louis R. Rowan Fellowship

Kaitlyn James, a Ph.D. student in the Graduate Group in Epidemiology at UC Davis, was awarded the 2015 Louis R. Rowan Fellowship by the California Thoroughbred Foundation. A 2010 graduate of Stanford University, James received her Master's Degree in Public Health from UC Berkeley in 2013, focusing on infectious diseases and vaccinology. She is currently researching various epidemiologic facets of Equine Protozoal Myeloencephalitis, including seroprevalence of the causative agents, potential links to *Toxoplasma gondii,* and refinement of the diagnostic flow chart for practitioners. James' work was mentored by Drs. Patricia Conrad and Nicola Pusterla. James expects to complete her Ph.D. in 2018, researching the utilization of epidemiologic tools such as mathematical modeling, causal inference, and outbreak investigation, to better understand and prevent equine diseases.

2016 Louis R. Rowan Fellowship

Jamie White was awarded the 2016 Rowan Fellowship by the California Thoroughbred Foundation. Jamie was working with a world renowned team, headed by Dr. Kyriacos Athanasiou, to bioengineer a cartilage implant that could be utilized to re-surface the equine joint. This work is likely to have significant translational implications for human athletes as well.

Jamie White comes from a diverse research background, which includes a combined nine years of experience in endocrinology, genetics, stem cell, and tissue engineering laboratories. White completed an undergraduate degree in biology at Northwestern University and has worked as a research assistant in the Carthew Laboratory focused on quantitative and systems biology at Northwestern University as well as the Brunet Laboratory focused on the molecular basis of longevity and age-related diseases at Stanford University, before starting her graduate education at UC Davis. White was in the Veterinary Scientist Training Program (VSTP), working toward a DVM and Ph.D. in Integrative Pathobiology. Following her education in the VSTP, White hopes to launch a career as an equine surgeon and orthopedic researcher. She has chosen to focus her research efforts on cartilage regeneration because joint disease remains one of the more elusive challenges to both human and veterinary medicine. Through her work in the Athanasiou Laboratory, White hopes to contribute to a further understanding of cartilage tissue engineering and mesenchymal stem cell chondrogenesis, which is the use of stem cells to generate cartilage.

2017 Louis R. Rowan Fellowhip

Anna Dahlgren, a Ph.D. candidate, was awarded the 2017 Louis R. Rowan Fellowship. Anna is working with Drs. Fern Tablin and Carrie Finno in the UC Davis Integrative Genetics and Genomics Graduate Group to analyze the underlying genetic basis of Atypical Equine Thrombasthenia (AET). This heritable platelet dysfunction affects one in every 150 Thoroughbreds and causes epistaxis (i.e. nosebleeds) and prolonged bleeding from injury. The potential role for this disorder in exercise-induced pulmonary hemorrhage (EIPH), a devastating disease of Thoroughbred racehorses, could drastically alter the way the Thoroughbred racing industry prevents and treats this important disease.

Following graduate school, Anna plans on continuing in academics and becoming a principal investigator dedicated to advancing knowledge in the field of animal genetics. She has a long-standing interest in improving the health of Thoroughbred racehorses and hopes to contribute to the industry.

Resource Funds

Director's Endowment

The Director's Endowment provides general funding for Center for Equine Health research, educational or welfare activities most critical to the needs of the horse in any given year. This endowment also provides the foundation for all Center endeavors.

Gregory L. Ferraro Endowed Directorship

This endowment was established in 2015 in honor of Dr. Gregory L. Ferraro, director emeritus of the Center for Equine Health, for his lifelong dedication to advancing the health and welfare of horses. The fund provides support to the director to develop the vision and plan for the enduring success of the Center.

Polly and Bill Swinerton Director's Endowment

This fund supports the activities of the Center for Equine Health Director to advance the facility's teaching, research and service missions.

William and Inez Mabie Family Foundation Endowment

This endowed fund was established to support the Center for Equine Health in its operational, educational and research efforts. Endowment earnings are distributed at the direction of the Center Director for advancing the health, well-being, performance, and veterinary care of horses through research and/or education.

Innovation Funds

Performance Horse Endowment

Medical problems of the mature show and event horse are the focus of the Performance Horse Endowment. This endowment also funds long-term, in-depth studies of problems that preclude horses from performing athletically as they age. Areas of study include colic, nutrition, cardiopulmonary health, degenerative orthopedic processes and infectious disease.

Equine Athletic Performance Laboratory Endowment

The Equine Athletic Performance Laboratory Endowment provides for the development of analytical methods for accurately evaluating the athletic conditioning and performance capability of individual horses. Once these analytical techniques are fully developed, the goal of the program is to provide an objective evaluation of the ability of drug agents and training methods to enhance performance and decrease the risk of injury in competitive horses.

J. D. Wheat Veterinary Orthopedic Research Laboratory Endowment

The J.D. Wheat Veterinary Orthopedic Research Laboratory investigates the underlying causes of bone fractures, their prevention, and new methods of fracture repair. This Laboratory was originally established by the Southern California Equine Foundation, Inc., with funds provided by the Dolly Green Research Foundation.

Bernard and Gloria Salick Equine Viral Disease Laboratory Endowment

This endowment supports a program dedicated to international scientific investigations of emerging equine viral diseases. Its goal is to identify and control viral diseases of the horse that can affect the international movement, commerce and health of competitive equine athletes.

Animal Rescue and Disaster Medicine Endowment

The Animal Rescue and Disaster Medicine Endowment supports the development of improved techniques for the rescue of large animals during natural disasters. The fund also provides for research into various medical conditions of the animals and the development of improved treatment regimens.

Lucy G. Whittier Endowment for Equine Perinatal and Infectious Disease

The Lucy G. Whittier Endowment is dedicated to improving the health and medical treatment of newborn foals and their dams and to conduct research on infectious diseases associated with foals.

Peray Memorial Endowment

The Peray Memorial Endowment is an important resource for resident house officers of the UC Davis Veterinary Medical Teaching Hospital to conduct equine respiratory disease and colic research.

Innovation Funds continued

John P. Hughes Memorial Endowment

Named after the founding director of the Center for Equine Health, the John P. Hughes Memorial Endowment provides funding for UC Davis Veterinary Medical Teaching Hospital resident house officers to conduct clinical research in any area of equine medicine or surgery.

Dan Evans Memorial Endowment

The Dan Evans Memorial Endowment provides funding for UC Davis Veterinary Medical Teaching Hospital resident house officers to conduct research in any area of equine medicine and surgery that is relevant to the development of their specialty board certification.

Enduring Legacy Endowment for the Advancement of Clinical Equine Medicine and Surgery

The Enduring Legacy Endowment was established to provide for the administration of experimental or high-risk therapies to severely ill or injured horses with unique veterinary conditions for which there is a high degree of learning value associated with their condition. The fund also supports the clinical trials program within the School of Veterinary Medicine.

Juliette Weston Suhr Fellowship Fund

The Juliette Weston Suhr Fellowship is awarded to postgraduate veterinary students who are interested in conducting research in the areas of exercise-related cardiopulmonary and metabolic disorders.

Sundance Ranch Endowment

This fund was established by the late Carol Green to provide funding support for research in biological and translational research in the pursuit of effective treatments and cures for systemic diseases of the horse. Ms. Green had particular interest in medical conditions related to the development of laminitis.

Patricia Yeretzian Endowment Fund

This fund was established by longtime Silver Stirrup Society members, Patricia and Paul Yeretzian. The fund supports equine research projects relating to reproduction and infertility disorders.

Simulcast Racing Contributions

In 1987, the Satellite Wagering Act (Senate Bill 14) designated one-tenth of one percent of California's simulcast racing handle to be used for equine research. In 1994, Senate Bill 518 was passed, designating the redistribution of the simulcast racing percentage. These funds support both the Center for Equine Health and the Kenneth L. Maddy Equine Analytical Chemistry Laboratory. This important laboratory has three components: (1) a full-service, routine drug testing program, (2) a forensic toxicology program, and (3) a pharmacology research and methods development program. The latter includes the development of new tests and documentation of drug testing effects on racehorse performance. In 2001, the Account Wagering Bill (Assembly Bill 471) was passed, directing simulcast contributions made through televised wagering to UC Davis equine research and drug testing programs.

CARDIOLOGY

Study of Causes and Diagnosis of Sudden Death in Racehorses (Grant #15-08)

Investigators: Francisco A. Uzal, DVM, M.Sc., Ph.D., DACVP, Robert Poppenga, DVM, Ph.D., DABVT, Santiago S. Diab, DVM, DACVP, Ashley Hill, DVM, MPVM, Ph.D., Rick Arthur, DVM

The number of equine sudden death cases in apparently healthy horses in California has increased over the past two years. This has created national and international negative attention on California horse racing, as sudden death adversely affects racehorse welfare, jockey safety and public perception of horseracing. Despite thorough post-mortem examinations and diagnostic work-ups, a definitive cause of death could not be established in approximately 50% of the cases of sudden death, although heart failure is suspected to be responsible for a large number of these deaths. Heart failure may be due to administration of substances such as cobalt (long known to cause cardiomyopathies in humans), vitamin B12 or levothyroxine (T4 thyroid hormone). However, no scientific evidence is available to support the claim that many of those horses die of heart failure and/or that those deaths are associated with the use of any particular substance.

This study facilitated the microscopic examination of the hearts of horses with sudden death and an equivalent number of horses euthanized due to catastrophic leg injuries (control group) in an attempt to find a correlation between sudden death and the presence of microscopic lesions in the heart.

How does this research benefit horses?

Sudden death is a devastating event that severely affects all members of the equine industry and the public. This study found that non-inflammatory cardiomyocyte injury (myofibrillar degeneration and contraction band necrosis) was the most important lesion found at a higher prevalence in sudden death horses than in control animals. Inflammatory lesions, fibrosis and miscellaneous lesions were found at similar prevalence in sudden death and control horses. A baseline cardiac necropsy protocol was established. Finding specific lesions in the heart of at least some of those horses will provide a diagnostic tool to determine the mechanism of death in future cases of sudden death.

Additionally, no significant differences in T3, T4 or liver cobalt concentrations were found between study and control horses, which suggests that at least in the group of horses studied, these substances were not associated with the cause of sudden death. If future studies are able to determine if the administration of cobalt, vitamin B12 and/or levothyroxine are a contributing factor additional preventive tools could be developed to avoid future sudden deaths.

This research was reported in the *Journal of Veterinary Diagnostic Investigation:* 29(4):381-382, 29(4):442-449.

Identification of Asymptomatic Heart Disease in Racing Thoroughbreds and Impact on Performance and Risk for Sudden Cardiac Death (Grant #14-04)

Principal Investigator: Joshua Stern, DVM, Ph.D., DACVIM

Subtle evidence of heart disease may be subclinical in high-level athletes until evaluated after extreme exercise. Changes in blood parameters that indicate heart disease, cardiac arrhythmias and heart function as seen by cardiac ultrasound may all be indicative of subtle but significant heart dysfunction after exercise. This concept, termed exercise-induced cardiac fatigue, has been documented in

To obtain additional information on a research study, please reference the grant number in your request.

performance horses but never evaluated in racing Thoroughbreds as a possible explanation for poor performance and sudden cardiac death.

How does this research benefit horses?

This was the first study to document the cardiac biomarker, cardiac troponin I, electrocardiogram (EKG) and cardiac functional change that is expected in high-level competing Thoroughbreds. This study establishes expected changes in each of these variables and simultaneously identified that outliers exist within the population. These findings may be useful to identify screening tests that could be applied to Thoroughbred racehorses to identify those at risk of heart injury and even sudden cardiac death. With the recently reported increase in sudden death after racing, evidence for possible testing strategies is of paramount importance. This study suggests that a larger data set with long-term follow-up looking at pre- and post-race EKG parameters, as well as cardiac troponin-I, may represent a method to detect horses at risk for cardiac events.

DRUG THERAPIES

Can Ketamine be Given Intramuscularly to Horses to Aid in Standing Sedation? (Grant #13-15)

Investigators: Sarah S. le Jeune, DVM, DACVS, DECVS, DACVSMR, CVA, Laurie K. Bohannon, DVM, Jodie Daglish, BVSc, Alonso Guedes, DVM, MS, Ph.D. and Bruno Pypendop, DrMedVet, DrVetSci, DACVAA

Ketamine, an injectable anesthetic agent, is commonly used intramuscularly (IM) to help with standard sedation in hypersensitive horses for routine treatments such as joint injections, stem cell injections and dental procedures. However, the efficacy of intramuscular ketamine as an adjunctive sedative and the disposition of intramuscular ketamine has not previously been reported in horses.

How does this research benefit horses?

The study showed that ketamine at a dose of 0.6mg/kg could be administered intramuscularly to horses and was well tolerated by all animals in the study, but ketamine administered alone (IV or IM) did not produce adequate levels of sedation. Administration of ketamine IM in addition to detomidine IV, produced a level of sedation in horses that was similar to detomidine IV alone, but horses were less sensitive to touching of the forelimb than with detomidine alone. This effect lasted 20 minutes.

The study successfully characterized the disposition of ketamine. It was determined that intramuscularly administered ketamine was poorly absorbed and the addition of detomidine affected the disposition of ketamine. Therefore, adding intramuscular ketamine to routine sedation protocols is a valid option for veterinarians to calm difficult or hypersensitive horses for routine procedures on the limbs and dental care.

Evaluation of Drug Techniques to Reduce Rapid Involuntary Eye Movements Caused By General Anesthetics (Grant #14-02)

Investigators: Robert J. Brosnan, DVM, Ph.D., DACVA, Monica R. Aleman, MVZ, Ph.D., DACVIM and D. Colette Williams, Ph.D.

Horses recovering from general anesthesia commonly experience rapid involuntary eye movement (nystagmus) that likely is associated with the lack of coordination and dizziness, in much the same way that a person spinning in a circle develops physiologic nystagmus and associated dizziness. Nystagmus and incoordination during post-anesthetic recovery increases the risk of injury and in some cases death during the period when the anesthesia is wearing off. Dr. Brosnan and his team investigated the use of midazolam and romifidine, both separately and in combination together, at various doses to reduce isoflurane induced nystagmus.

How does this research benefit horses?

The study showed that post-anesthetic administration of romifidine may be able to stop isoflurane-induced nystagmus and improve equine recoveries, but drug infusions (rather than a single dose as commonly administered) may be necessary to achieve these aims. Improved recovery quality will reduce complications associated with anesthesia and surgery in horses.

Pharmacokinetics of Chloramphenicol in Healthy Horses (Grant #14-01)

Investigator: Gary Magdesian, DVM, DACVIM, DACVECC, DACVCP, CVA, Trisha Patel, PharmD, Krista E. Estell, DVM, DACVIM, Heather Knych, DVM, Ph.D., DACVCP, Valerie Wiebe, PharmD and Jeanne Bowers-Lepore, DVM

Despite scarce and conflicting research on the pharmacokinetics of orally administered chloramphenicol in horses, it is commonly used in equine practice. Single dose administration has demonstrated variable oral absorption and a very short half-life using older analytical methodology, questioning the validity of its use in horses at some of the published recommended doses (as low as 25-30 mg/kg). There is a need to evaluate the pharmacokinetics of chloramphenicol, including compounded formulations which are commonly used in equine practice. Additionally, based on the pharmacokinetic results, the types of bacteria that chloramphenicol will be effective against warranted study.

How does this research benefit horses?

This study discovered that, due to relatively poor absorption when administered orally, the resulting concentrations of the drug in the blood will only eliminate certain bacteria, such as Streptococcus and non-enteric bacteria. Specifically, chloramphenicol should be used only for treating bacteria with MIC values of ≤ 2 µg/mL, with dosing at 50 mg/kg q 6 hours. The results of this study provide equine practitioners with valuable information regarding dosing and appropriate use of chloramphenicol in the horse.

Pharmacokinetics and Selected Physiological and Behavioral Responses of Trazodone Following Intravenous Administration to Exercised Horses (Grant #14-06)

Investigators: Heather Knych, DVM, Ph.D., DACVCP, Khursheed Mama, DVM, DACVA, Eugene P Steffey, VMD, Ph.D.

Trazodone is a selective serotonin reuptake inhibitor that has the potential to be used as a calming medication in horses. There are no reports documenting the pharmacology of trazodone in horses but, given its pharmacological profile in both humans and dogs, it is likely to have applicability as a behavioral modifier in horses as a calming medication in a variety of circumstances, and could also be used to modulate performance. Knowledge of the pharmacodynamic profile of trazodone is essential to further elucidating beneficial and potential side effects. Characterization of the pharmacokinetic profile of trazodone and, if produced by horses, its active metabolite will additionally facilitate detection in the event of its inappropriate use in performance animals.

How does this research benefit horses?

In this study, pharmacokinetic parameters were determined for trazadone following intravenous and oral administration. Following intravenous administration, horses were ataxic and exhibited whole body tremors while horses appeared sedate following oral administration. The results of this study provide baseline information to encourage its appropriate use in horses as a calming medication. The results will also facilitate detection of this drug in situations of inappropriate administration.

GENETICS

Identification of Putative Genetic Mutations Associated with Equine Neuroaxonal Dystrophy

(Grant #15-03)

Investigators: Carrie Finno, DVM, Ph.D., DACVIM and Erin Burns, BS

Equine neuroaxonal dystrophy (eNAD) is a devastating neurological condition that develops during the first year of life in genetically predisposed foals maintained on a vitamin E deficient diet. Affected horses suffer from incoordination, preventing their use as a riding animal. To develop a genetic test for eNAD, an adequate number of horses (eNAD-affected and unaffected) and genetic markers (DNA sequence on a chromosome) are required. Previous attempts at identifying the gene involved in eNAD were limited to only 54,000-70,000 genetic markers, whereas the newest marker test contains 670,000 markers. Horses affected with eNAD have very low vitamin E levels, supporting the idea that a genetic mutation involved in vitamin E transport or metabolism is responsible for the disease.

How does this research benefit horses?

This study identified a region on equine chromosome 7 for further evaluation for eNAD. Using the combination of genotyping and sequencing data, the region was explored for haplotypes (i.e. markers on stretches of chromosome that are inherited together) that could be associated with the disease. With continued investigation of the region on chromosome 7, investigators hope to develop a genetic test for eNAD, thereby allowing breeders to determine the need for supplementation of pregnant mares and foals to prevent the disease.

Genetic Investigation of Juvenile Idiopathic Epilepsy in Arabian Foals (Grant #15-10)

Investigators: Monica Aleman, MVZ, Ph.D., DACVIM and Carrie Finno, DVM, Ph.D., DACVIM

Juvenile ldiopathic Epilepsy (JIE) is a disorder in Egyptian Arabian foals that causes seizures. Potential life threatening complications include head injury and aspiration pneumonia. Although the disorder is heritable, the genetic mutation is not yet identified. This project investigated the genetic cause of JIE by performing a genome-wide association study. A region on chromosome 1 was identified as significantly associated with the JIE phenotype. Two JIE-affected horses underwent whole genome sequencing and candidate genetic mutations have been identified.

How does this research benefit horses?

The identification of a region on chromosome 1 is a significant step forward. Additional studies are underway to determine which of these genetic mutations may be responsible for JIE in Arabian foals and allow for the development of a genetic test. This will provide breeders the ability to screen mares and stallions for JIE prior to breeding.

Identifying a Genetic Basis of Unexplained Sudden Death in Racehorses (Grant #15-26)

Investigator: Joshua Stern, DVM, Ph.D., DACVIM

Despite thorough pathologic and toxicologic investigations, no unifying, definitive cause has been identified to explain the increase in sudden cardiac death events of racing Thoroughbred. Similar events are observed in human athletes and are often attributed to genetic mutations and predisposition to abnormal conduction within their hearts, yet no genetic investigation into these equine sudden death

cases has been performed. This study sought to identify genetic markers associated with sudden death to provide a foundation for future investigations.

The DNA was obtained from 20 horses that died suddenly with no clear cause of death and compared to DNA of 28 matched control horses that were euthanized due to orthopedic injury and then compared across the entire genome to obtain a list of genetic markers for analysis. The study's results did not identify a significant area of the genome associated with sudden death.

How does this research benefit horses?

This work confirmed that future genetic investigations of sudden death require fresh tissue samples or blood samples to be stored and high-quality DNA samples extracted as soon as possible. The study also showed that the number of cases and controls was insufficient and future evaluations should aim for a sample size that considers this condition to be polygenic or multifactorial. Finally, this data supports that continued efforts looking for environmental causes of sudden death in the Thoroughbred racehorse are warranted.

Genetic Investigation of Limbal Squamous Cell Carcinoma in Haflinger Horses (Grant #15-12)

Investigators: Rebecca Bellone, Ph.D., Mary Lassaline, DVM, Ph.D., M.A., DACVO

Squamous cell carcinoma (SCC) is the most common cancer of the equine eye and the second most common tumor of the horse overall. SCC frequently originates in a region of the eye known as the limbus and can quickly spread to other parts of the eye, leading to vision loss and destruction of the eye. Haflinger horses are over-represented for this disease, on average are affected at a younger age, and affected horses trace back to a common ancestor; making this an important breed to study the genetics of the disease. This study sought to identify and investigate the DNA mutations that cause this disease. A genetic variant was identified with a strongly associated risk for cancer in Haflingers.

How does this research benefit horses?

This work led to the development of a commercially available DNA test offered at the Veterinary Genetics Laboratory, UC Davis. Clinicians are utilizing the DNA test to identifying Haflinger horses at highest risk for this cancer so that these animals can be examined earlier and more frequently. Breeders are also utilizing this test to make informed breeding decisions, which should help to lower the incidence of cancer in the breed.

Because this genetic variant does not explain all of the limdal SCC cases observed, data analysis is in progress to determine if additional genetic variants are involved. In the long term, understanding the genes and biological pathways disrupted in ocular SCC may lead to the development of new and more effective treatments and thereby prevent visual impairment associated with loss of the eye.

The study was published in the *International Journal of Cancer* 141(2):342-353.

Study of Genetic Cause of Melanoma Cancers in Connemara Ponies (Grant #14-22)

Investigator: Alain Theon, DVM, MS, Ph.D., DACVR

Connemara Ponies, similar to other horses with a graying hair coat, have an 80% lifetime risk of developing melanomas. Although Connemara ponies are not predisposed to melanoma cancer, they have an increased risk due to selective breeding for gray phenotype. The study focused on identifying actionable genomic targets associated with melanoma that could be manipulated through genetic screening and careful breeding to decrease or eliminate the risk of developing melanomas in Connemara ponies and other breeds. The investigation also sought

to further define the molecular mechanisms responsible for development of melanomas in patients at risk, which will aid in targeting treatment development efforts.

The study required the establishment of a biobank to provide quality samples for research. Through the support of the American Connemara Pony Society, the UC Davis Center for Equine Health and the Cunningham and Doyle Charitable Trust Fund, biospecimens of 72 pure-bred Connemara ponies were collected from across the U.S.

How does this research benefit horses?

Preliminary identification of genetic variants was accomplished, which will help to guide future studies with the ultimate goal of being able to develop genetic testing tools to inform the Connemara pony community and potentially breeding decisions to decrease the disease prevalence. The establishment of the biobank with the Connemara pony biospecimens will aide future genetic studies targeted to this breed.

Chronic Progressive Lymphedema (Grant #14-21)

Investigators: Danika L. Bannasch, DVM, Ph.D., Verena K. Affolter, DVM, Ph.D., Claudia Sonder, DVM, Brittany Dally, M.S. student

Chronic progressive lymphedema (CPL) in the horse is a disabling condition that stems from a buildup of lymph fluid in the lower limbs. Draft horses (especially Shires, Belgians, Clydesdales, Gypsy Vanners, and Friesians) are most commonly affected by this condition, with the majority of animals presenting with varying severities of clinical signs. Due to the large number of horses displaying clinical signs of CPL in affected breeds, a genetic predisposition is suspected.

Two genome-wide association studies were conducted to identify a genetic component within the Friesian horse breed that may cause CPL or predispose them to the condition. Unfortunately, neither of these studies was able to identify a genomic region on a chromosome that was associated with CPL. As this form of lymphedema appears to be predominantly in draft horse breeds, the size of the horse was investigated as a potential contributing factor or indicator of CPL development. Height, weight, and limb measurements at four locations were obtained from a total of 37 horses (28 cases and 9 controls). Of these measurements, significance was achieved for two measurement locations, forearm (radius and ulna) and gaskin lengths, demonstrating a potential correlation between animal size and CPL status within the Friesian breed.

How does this research benefit horses?

Increased understanding of the cause and predisposition of this condition in draft horse breeds will assist veterinarians in developing more consistent treatment plans to manage this condition and provide lifelong support to keep affected horses comfortable and mobile. These study results will help to inform future studies aimed at identifying a genetic cause and the potential development of a genetic test which would assist breeders.

MEDICINE and INFECTIOUS DISEASE

Frequency of Antibody Detection to Equine Coronavirus (ECoV) in Healthy Horses Living in the U.S. (Grant #16-20)

Investigators: Nicola Pusterla, DVM, Ph.D., DACVIM, Samantha Barnum, M.S., Kaitlyn James, M.S.

Despite the sporadic occurrence of Equine Coronavirus (ECoV) outbreaks in adult horses, the overall number of horses testing positive for this virus in horse populations has remained poorly investigated. Seroprevalence data, based on blood serum specimens, is needed to better understand the epidemiology of ECoV, evaluate diagnostic modalities and develop preventive measures. Study results revealed the seroprevalence to ECoV was 9.6% in 5,247 healthy adult horses from

18 different states. Seropositivity was significantly associated with horses from the Midwest, particularly in draft horses.

How does this research benefit horses?

This study represents the first known and most comprehensive seroprevalence study on ECoV in healthy adult horses. Factors contributing to a higher ECoV seroprevalence in the Midwest could be related to a higher population of ECoV seropositive draft horses used for farm and ranch work and breeding in this geographic region. Longitudinal studies are needed to further investigate the various observations and risk factors.

This research was reported in the *Veterinary Journal* 2017 Feb;220:91-94

Development of a Serological Test to Detect Antibodies to Equine Coronavirus in Adult Horses (Grant #14-09)

Investigators: Nicola Pusterla, DVM, Ph.D., DACVIM, Samantha Barnum, MS

Recently, equine coronavirus (ECoV) has been associated with febrile and enteric disease in adult horses. Since 2011, the laboratory team has been involved with several outbreaks of ECoV across the U.S. The main clinical signs reported were anorexia, lethargy and fever. Although polymerase chain reaction (PCR) testing detects the antigen during the acute disease phase, this project set out to develop an equine specific antibody-test which would allow determination of exposure amongst infected and asymptomatic horses.

How does this research benefit horses?

The study established and validated a new S protein-based ELISA test to detect specific antibodies to ECoV. Although RT-PCR on feces is considered the best diagnostic modality to support ECoV infection, this new test will facilitate investigation of disease and infection rates in various horse populations in order to better understand the epidemiology of this emerging equine virus.

Iodide Supplementation as a Strategy for Enhancing Equine Innate Airway Defenses: A Possible Preventative Therapy for R. Equi Pneumonia in Foals (Grant #15-21)

Investigators: Meera Heller, DVM, Ph.D., DACVIM, Fauna Smith, DVM, Ken Jackson, M.S., Johanna L. Watson, DVM, Ph.D., DACVIM

Rhodoccocus equi causes pneumonia in foals and is a major cause of illness and even death. It also costs the equine industry millions of dollars for treatment and prevention. Sodium Iodide has been used to treat similar types of infections in humans and animals for over a hundred years, before the discovery of antibiotics. A recent study showed that oral supplementation with iodine in humans increases the levels of hypoiodous acid (HOI) on the surfaces of the respiratory tract, and this is a potent anti-bacterial and antiviral defense mechanism. There are two potential roles for iodine in the augmentation of the immune response; one is as a treatment for *R. equi* infections and the other is to prevent infection via respiratory tract surfaces.

The study demonstrated that live *R. equi* bacteria could be killed *in vitro* by sodium iodide. Additionally, when cells from horse's lungs were experimentally infected with *R. equi in vitro,* sodium iodide slowed the rate of infection. However, when those same cells were infected with *R. equi* and then treated with sodium iodide, killing of *R. equi* was not enhanced. Therefore, sodium iodide may play a preventative role in the development of clinical *R. equi* pneumonia in foals.

How does this research benefit horses?

The killing of bacteria in the airways and resulting decrease in the rate of infection could aid in the prevention of *R. equi* pneumonia in foals. Based on these findings, the use of sodium iodide as a preventative treatment for *R. equi* pneumonia in foals warrants further investigation.

Toxoplasma Gondii Seroprevalence and Association with Equine Protozoal Myeloencephalitis (EPM): A Case-Control Study amongst California Horses (Grant #16-04)

Investigators: Nicola Pusterla, DVM, Ph.D., DACVIM, Patricia A. Conrad, DVM, Ph.D., Woutrina Smith, DVM, MPVM, Ph.D. and Kaitlyn James, MS

While the causative agents of equine protozoal myeloencephalitis (EPM) are known, the transition from infection with *Sarcocystis neurona* and *Neospora hughesi* to the clinical disease of EPM is not yet understood. Marine mammals infected with both *S. Neurona* and *Toxoplasma gondii* have shown increased severity of neurologic disease. Co-infection between the causative agents of EPM and *T. gondii* may contribute to the transition from infection to clinical disease in horses. This study sought to determine the seroprevalence, frequency of blood serum samples, with *T. gondii* amongst California horses with neurologic signs compatible with EPM and neurologically normal horses.

How does this research benefit horses?

In this study, horses with higher titers to *T. gondii* (80, 160, 320) were more likely to have clinical signs compatible with EPM than healthy, non-neurologic horses. While there was no evidence that co-infections by *T. gondii* and *S. neurona/N. hughesi* were required for clinical signs of EPM to develop, the association between *T. gondii* seropositivity and clinical EPM suggested that *T. gondii* was associated with neurologic signs in the study population of California horses. Serologic testing of cerebrospinal fluid and isolation of *T. gondii* in EPM suspect cases should be considered. Future studies investigating the relationship between *T. gondii* and EPM are warranted.

Frequency of Antibody Detection to *Sarcocystis Neurona* and *Neospora Hughesi* in Healthy Horses from various areas of the U. S. (Grant #14-03)

Investigators: Nicola Pusterla, DVM, Ph.D., DACVIM, Patricia A. Conrad, DVM, Ph.D., Heather Fritz, DVM, Ph.D., Andrea Packham, MS and Kaitlyn James, MS

Equine protozoal myeloencephalitis (EPM) is a debilitating cause of neurologic disease in horses across the U.S. Two protozoa pathogens, *Sacrocystic neurona* and *Neospora hughesi,* can cause EPM; however, *N. hughesi* is most frequently reported in the western half of the U.S. This study investigated the prevalence of antibodies to both protozoa across the United States.

How does this research benefit horses?

This study discovered that horses in regions previously considered at lower risk of infection with *S. neurona,* and perhaps more importantly, *N. hughesi,* experienced higher rates of infection than previously thought. Practitioners in all regions of the U.S. should therefore consider testing for both causative agents when presented with a suspect EPM case based on the seroprevalence of *S. neurona* and *N. hughesi* in healthy equines.

OPHTHALMOLOGY

Effect of Brimonidine and Brimonidine-Timolol on Intraocular Pressure in Normal Equine Eyes

(Grant #15-09)

Investigators: Mary Lassaline, DVM, Ph.D., MA, DACVO, Sara Thomasy, DVM, Ph.D., DACVO

Glaucoma is a disease characterized by elevated intraocular pressure (IOP) and is a common cause of blindness in horses. Medications such as brimonidine and brimonidine-timolol have been developed to reduce IOP in people with glaucoma by decreasing the amount of fluid within the eye, thereby preserving functional vision and controlling pain associated with this disease. This study investigated the efficacy and safety of two glaucoma drugs, brimonidine and brimonidine-timolol, at lowering intraocular pressure in horses.

How does this research benefit horses?

The study showed that there were no adverse effects in normal equine eyes treated with brimonidine or brimonidine-timolol. While both medications are well tolerated in normal horses, treatment with these medications did not result in a significant decrease in IOP in the normal horses tested. It is not known whether these drugs would decrease intraocular pressure in horses with glaucoma. It was noted that horses with glaucoma may respond differently than normal horses.

Now that the safety of these two medications has been established, the next step is to test their efficacy in treating the disease in glaucomatous horses. Identifying new ophthalmic medications that successfully lower IOP in horses with glaucoma may decrease the severity of pain and the incidence of blindness in horses with this devastating disease.

This research was reported in the *Equine Veterinary Journal* 2017 Nov;49(6):810-814

ORTHOPEDICS and LAMENESS

Mechanisms of Bone Loss (Osteoporosis) in Horses from Geographic Regions with Soils High in Toxic Silicate (Grant #12-04)

Investigator: Susan Stover, DVM, Ph.D.

Silicate Associated Osteoporosis (also known as Bone Fragility Syndrome) is a devastating disease that causes nonspecific chronic lameness and neck pain, bone deformities and fractures, and death or humane euthanasia of horses that breathe dust from soil containing toxic silicate particles (cristobalite). Most horses have concurrent lung disease caused by the inhalation of the cristobalite, but the reason for the skeletal disease in horses with this lung disease is unknown. If the mechanism that links the bone disease to the lung disease can be discovered, further research for the treatment and prevention of the bone disease can be pursued.

The study identified extensive bone loss, decrease in bone mineral, and abnormal bone architecture in the ribs of affected horses which explains the markedly weakened bones and the high fracture risk in affected horses. The bone abnormalities were consistent with abnormal function of cells responsible for bone resorption (osteoclasts). Vigorous attempts by bone forming cells (osteoblasts) to form new bone were also present, but insufficient to compensate for the marked and disorganized bone loss.

How does this research benefit horses?

Horse owners with horses suffering from SAO incur financial and emotional loss and, in some instances, devaluation of real estate with soil containing toxic substances. Information obtained from this study will add to the body of knowledge surrounding the disease. Determination of the major dysfunction in the disease is expected to guide further studies into disease mechanisms. Understanding these mechanisms could help to identify potential targets for the development of treatment and preventive strategies. This investigation was a first step in understanding the nature of the bone loss in affected horses.

Deciphering Mechanisms of Bone Loss (Osteoporosis) in Horses from Geographic Regions with Soils High in Toxic Silicates (Grant #14-07)

Investigator: Susan Stover, DVM, Ph.D. and Regina Zavodovskaya, MS, DVM, DACVP

SAO is a devastating disease of horses that breathe dust from soil containing toxic silicates (cristobalite). The disease results in extensive bone loss, painful skeletal deformities, bone fractures, and death or humane euthanasia. Most horses with SAO have a concurrent lung disease called silicosis, which is caused by the inhaled cristobalite. Investigating the link between the lung disease and bone loss could ultimately lead to treatment and prevention strategies for SAO.

How does this research benefit horses?

This study utilized computer programs to determine the genetic differences between SAO affected and control horses. Differences in the gene profiles were found that affect bone health, but surprisingly the genetic differences highlighted bone formation activation and not bone resorption activation.

SAO in horses is associated with certain regions of California and results in the loss of affected horses, as well as the financial loss and emotional burden for horse owners. The identified genes could be used as a much needed tool for the detection of affected horses at an early stage of the disease when they can be treated to slow progression of SAO, and as markers for future studies that may link similar diseases in other animals and humans. The discovery of the genes specific to affected horses will guide future research on the path to understanding the mechanism by which the lung disease causes the bone disease. Early diagnosis, targeted therapy for osteoporosis and potential preventive strategies may emerge as a result of the discovery of the SAO associated genes.

New Magnetic Resonance Imaging Approach to Evaluation of Tendons and Ligaments in the Equine Foot (Grant #13-05)

Investigators: Mathieu Spriet, DVM, MS, DACVR, DECVDI, Brian Murphy, DVM, Ph.D., DACVP and Anthony DeRouen, DVM

Ligament and tendon lesions in the foot are common causes of equine lameness. Magnetic resonance imaging (MRI) has markedly contributed to better recognition and characterization of these lesions, however subtle and early lesions remain a

diagnostic challenge. New quantitative MRI techniques have shown promising results in the human Achilles tendon and equine metacarpal tendon disorders. It was hypothesized that this new MRI technique will increase sensitivity for detection of subtle lesions and lesions at an earlier stage of progression while also providing quantitative diagnostic information to more accurately and consistently characterize the nature of the lesions.

How does this research benefit horses?

The study results showed that abnormal tendons had a different appearance than normal tendons using this new quantitative MRI technique. These tendons were more heterogeneous, with areas displaying increased values of the measured MRI parameter. The increased MRI parameter correlated with an increase glycosaminoglycan content of the tendon, which is known to be related to degenerative changes of the tendon.

This study confirms that changes at the molecular level can be appreciated with this new MRI approach. This technique might provide additional information regarding the underlying mechanisms leading to lesion development and possible earlier intervention in soft tissue injury.

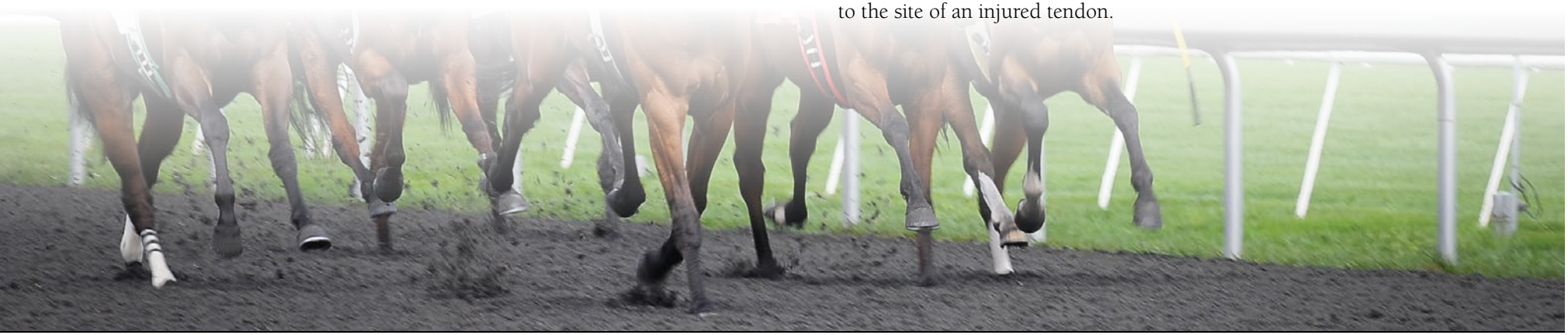
The Effect of Decorin and Biglycan Modulation on Equine Tendon Formation (Grant #15-06)

Investigators: Michael J. Mienaltowski, DVM, Ph.D. and Keith Baar, Ph.D.

Under normal development and growth conditions, tendon formation in the horse involves the creation of a strong, highly organized collagen-rich tissue capable of withstanding great tension during locomotion. Recovery outcomes for horses suffering from a tendon injury are generally incomplete and result in chronic lameness, thus having a huge impact on performance. When compared to healthy conditions, the repair response mounted by the cells of the tendon, and its surrounding tissue, is inferior and would benefit from strategies that bolster the response of these cell populations and strengthen the organization of the tissue to a state closer to that of healthy tendon. One strategy for improving tendon healing is the introduction of exogenous proteins that act to promote and stimulate tendon formation. Molecules like biglycan and decorin play several roles in maintaining tendon structure and function; they inform cells in the tendon as to their fate and they regulate collagen fibril organization.

How does this research benefit horses?

The study results showed that the addition of purified bovine biglycan and decorin did stimulate tendon formation. These findings are encouraging and support a role for the utilization of exogenous biglycan and decorin as a cost-effective treatment strategy to improve tendon repair. Ongoing studies will provide additional information to aid in the development of strategies to add biglycan and/or decorin to the site of an injured tendon.



Heel Movement and Hoof Wall Deformation with Different Nail Positions applied to the Horse Shoe

(Grant #15-14)

Investigators: Susan Stover, DVM, Ph.D. and Vanessa Dahl, MS (Ph.D. student)

Racehorses exhibit long toe/low heel conformation which has been associated with increased risk for fetlock injuries and breakdown. Shoeing techniques have an impact on hoof growth which can lead to this long toe/low heel hoof conformation.

We hypothesize that the number and position of nails used to attach the shoe to the hoof affect hoof expansion, hoof wall distortion, and fetlock extension. Furthermore, we hypothesize that nails placed closer to the heels of the hoof will produce effects that could promote the development of the long toe/low heel hoof conformation.

The effect of nail distribution on hoof heel expansion, heel distortion, and fetlock extension was studied in the forelimbs from 9 horses. Each limb was tested a total of 5 times under the following conditions: unshod; shod with 10 nails, 6 nails, and 2 nails; and again unshod for comparison to initial conditions.

How does this research benefit horses?

It was discovered that nails placed closer to the heels of the hoof decreased the amount of expansion in the heels and quarters of the hoof during limb loading. Additionally, nails placed closer to the heels resulted in hoof wall distortion, leading to the heels moving more dorsally (i.e. forward) than without a shoe. Fetlock angle decreased with nails placed closer to the heels of the hoof. Application of horseshoes is a factor that can be easily managed and could be a viable method to prevent injury in racehorses and performance horses.

Assessment of a New Imaging Technique to Detect Active Lesions in the Horse Foot

Investigators: Mathieu Spriet, DVM, MS, DACVR, DECVDI, Larry Galuppo, DVM, DACVS

Imaging of the horse foot has markedly improved over the past 15 years with the development of computed tomography (CT) and magnetic resonance imaging (MRI). Lesions that were unrecognized in the past can now be detected. The current challenge is to distinguish between active lesions and chronic inactive lesions in order to design appropriate treatment plans and for the assessment of the effectiveness of those therapies. This study assessed the effectiveness of positron emission tomography (PET) imaging for both soft tissue and bone lesions.

How does this research benefit horses?

The study demonstrated that the PET imaging technology produced high-quality images of the feet and fetlock and the imaging procedures were safe for both the horse and the staff. A wide range of lesions were identified including tendon, ligament, bone and joint lesions not identified with other imaging modalities and abnormal activity in the hoof of a horse with laminitis. The investigators predict that PET will become an invaluable research tool in particular for tendon and laminitis research. PET also has direct clinical applications for the early identification of bone and joint lesions.

Effect of Arena Surface on Fetlock Motion in Jumping Horses (Grant #14-05)

Investigator: Susan Stover, DVM, Ph.D.

Injuries to structures that support the fetlock, pastern, and hoof (suspensory ligament, superficial and deep digital flexor tendons) are the primary causes of performance limitations in show jumpers. The likelihood of injury to these structures increases with high limb loads and greater fetlock extension. Characteristics of the arena surface affect maximum limb loads, and thus the risk for injury. Knowledge of how arena surfaces contribute to the risk for injury can lead to recommendations for arena surface composition and management for injury prevention.

The project studied both dirt and synthetic arena surfaces testing with the approach that a less stiff, more compliant arena surface, with sufficient strength to support the hoof, could result in lower limb loads and lesser fetlock joint hyperextension, and thus have a lower likelihood of inducing common injuries.

Investigators found that the dirt arena surface was stiffer and had higher vertical impact loads than the synthetic surface. Therefore, the dirt arena had more resistance to deformation of the hoof into the surface. However, the synthetic arena surface had higher cohesion (i.e. resistance to horizontal motion or slide of the hoof). During take-off for the jump, fetlock extension and hoof movement were greater on the synthetic arena than the dirt arena surface. During landing, fetlock extension was greater and the toe of the hoof penetrated further into the synthetic arena than the dirt arena surface.

How does this research benefit horses?

Fetlock and hoof motions were found to differ during take-off and during landing from a jump between different arena surfaces that had different mechanical behaviors. Because extreme fetlock and hoof motions increase the risk for injury, arena surface design and management have the potential to prevent injuries in show jumping horses. However, further work is needed to determine the optimum arena surface design and management for injury prevention.

REGENERATIVE MEDICINE

Using Stem Cells to Engineer Cartilage for Joint Repair in Horses (Grant #15-17)

Principal Investigator: Kyriacos A. Athanasiou, MS, PhM, Ph.D.

Joint injuries occur frequently in the equine athlete, but effective treatments for cartilage repair are yet to be discovered due to the tissue's inherent lack of healing response. Tissue engineering seeks to grow healthy new cartilage constructs in a controlled laboratory environment; however, methods need to be developed not only to select an appropriate cell source, but also to ensure that the engineered cartilage possesses adequate properties for implantation. The study determine that Mesenchymal Stem Cells (MSCs) derived from umbilical cord blood formed superior neocartilage than MSCs from equine bone marrow.

How does this research benefit horses?

Using tissue engineering for cartilage repair is a potential tool to increase the success rate of surgical intervention as well as to hasten recovery times by replacing defective cartilage with a healthy neocartilage implant. Identifying an ideal cell source is the first step toward generating a viable cartilage repair product. This study demonstrated that cord blood derived MSCs may be used to produce viable cartilage grafts, as neocartilage produced from these MSCs have properties that resemble native equine articular cartilage in terms of composition and mechanical properties. This work holds exciting translational applications for human joint resurfacing.

REPRODUCTION

How Long Does the Antibiotic Ceftiofur Remain Effective in the Uterus after Intrauterine Infusion in Both Healthy Mares and Mares with a Uterine Infection? (Grant #13-12)

Investigators: Camilla J. Scott, BVetMed, MRCVS, DACT, Ghislaine A. Dujovne, DVM, MS, DACT and Bruce W. Christensen, DVM, MS, DACT

Bacterial endometritis is a leading cause of infertility in the mare and a major cause of economic loss to the equine industry. The use of intrauterine ceftiofur to treat endometritis is common practice; however, its efficacy had not been evaluated, especially in clinical cases of endometritis. A primary question was how long the ceftiofur remained at an effective concentration following administration for successful targeting of the infection in both healthy mares and mares with a uterine infection. The study showed that endometrial tissue concentrations of ceftiofur in healthy mares were above the concentration required to target common uterine infections for the 48 hour testing period. But in infected mares, tissue concentrations of ceftiofur were only above target concentrations for Escherichia coli for 6 hours and *Streptococcus zooepidemicus* for 24 hours.

How does this research benefit horses?

The results of this study suggest that healthy endometrial tissue retains target concentrations of ceftiofur for longer than inflamed tissue. In healthy mares, a prophylactic ceftiofur infusion would appear to be effective for at least 48 hours; however, in mares infected with *S. zooepidemicus,* a daily infusion protocol is required to avoid treatment failure. Knowing the length of time the antibiotic remains effective will provide veterinarians important information to design and implement treatment plans for their patients. Future studies to evaluate intrauterine antibiotic treatment for endometritis on mares with endometritis is a logical next step.

Partnerships Lead to Innovations IN VETERINARY CARE

One of the many strengths of the UC Davis School of Veterinary Medicine is the guiding principle of collaboration in a multi-disciplinary approach to solve complex problems. These partnerships combine to investigate disease, improve techniques, identify treatments and advance knowledge.

Claire Giannini Hoffman Equine Athletic Performance Laboratory

Capabilities in equine sports medicine are enhanced significantly with the Claire Giannini Hoffman Equine Athletic Performance Laboratory (EAPL). This state-of-the art, climate-controlled facility includes two high-speed Mustang treadmills, a video motion analysis system, and the laboratory equipment and support necessary to perform in-depth investigations of respiratory, cardiac, musculoskeletal, and metabolic causes of poor performance and exercise intolerance.

The EAPL is home to an integrated multidisciplinary clinical and research equine sports medicine program anchored by Dr. Jim Jones, an internationally-renowned equine exercise physiologist, and supported by faculty from the veterinary hospital's Equine Surgery and Lameness, Equine Ultrasound, and Equine Medicine Services.

J.D. Wheat Veterinary Orthopedic Research Laboratory

The J.D. Wheat Veterinary Orthopedic Research Laboratory is an environment in which multidisciplinary studies pertaining to musculoskeletal disorders of animals and humans can be conducted. The goal of researchers participating in the laboratory is to understand the physiologic process of injury and musculoskeletal disease in performance, companion and production animals as well as in humans.

RESEARCH SPOTLIGHT #1

A missense mutation in damage-specific DNA binding protein 2 is a genetic risk factor for limbal squamous cell carcinoma in horses

Rebecca R. Bellone, Jiayin Liu, Jessica L. Petersen, Maura Mack, Moriel Singer-Berk, Cord Drögemüller, Julia Malvick, Barbara Wallner, Gottfried Brem, M. Cecilia Penedo, Mary Lassaline

International Journal of Cancer 141(2):342-353.

Squamous cell carcinoma (SCC) is the most common cancer of the equine eye, frequently originating at the limbus, with the potential to invade the cornea, cause visual impairment, and result in loss of the eye. Several breeds of horses have a high occurrence of limbal SCC implicating a genetic basis for limbal SCC predisposition. Pedigree analysis in the Haflinger breed supports a simple recessive mode of inheritance and a genome-wide association study (N = 23) identified a 1.5 Mb locus on ECA12 significantly associated with limbal SCC ($P_{corrected}$ = 0.04). Sequencing the most physiologically relevant gene from this locus, *damage specific DNA binding protein 2 (DDB2),* identified a missense mutation (c.1013 C>T p.Thr338Met) that was strongly associated with limbal SCC (P = 3.41 × 10−10). Genotyping 42 polymorphisms narrowed the ECA12 candidate interval to 483 kb but did not identify another variant that was more strongly associated. *DDB2* binds to ultraviolet light damaged DNA and recruits other proteins to perform global genome nucleotide excision repair. Computational modeling predicts this mutation to be deleterious by altering conformation of the β loop involved in photolesion recognition. This *DDB2* variant was also detected in two other closely related breeds with reported cases of ocular SCC, the Belgian and the Percheron, suggesting it may also be a SCC risk factor in these breeds. Furthermore, in humans xeroderma pigmentosum complementation group E, a disease characterized by sun sensitivity and increased risk of cutaneous SCC and melanomas, is explained by mutations in DDB2. Cross-species comparison remains to be further evaluated.

Partnerships Lead to Innovations IN VETERINARY CARE continued

The Center for Equine Health provides funding for studies to identify improved diagnostic, therapeutic and preventive techniques to combat musculoskeletal injury and disease in horses.

Kenneth L. Maddy Equine Analytical Chemistry Laboratory

The Kenneth L. Maddy Equine Analytical Chemistry Laboratory provides a drug testing program with the highest quality standards, employing the most innovative methodology and newest analytical technology, in order to ensure the integrity of horse racing.

The Laboratory's two-fold mission includes expanding and disseminating new information regarding therapeutic medications in order to improve the welfare of California performance horses.

Veterinary Center for Clinical Trials

The Veterinary Center for Clinical Trials (VCCT) is advancing medical care for horses by developing and investigating alternative diagnostic approaches for a variety of diseases. The VCCT is frequently enrolling equine patients for a variety of studies, ranging from cardiology to orthopedics.

Veterinary Institute for Regenerative Cures

The UC Davis School of Veterinary Medicine is a national leader for veterinary regenerative medicine under the direction of the Veterinary Institute for Regenerative Cures. The Institute has established laboratory techniques and animal models that have been used to study regenerative therapies for veterinary and human medicine. It has characterized equine stem cells isolated from different tissues (i.e. fat, bone marrow, umbilical cord blood and umbilical cord tissue) with a focus on adult-derived mesenchymal stem cells. The Institute has a foundation in collaborative, interdisciplinary "disease teams" that include basic research faculty and clinical faculty that focus on "bench to bedside" translation of stem cell therapies.

Veterinary Genetics Laboratory

The Veterinary Genetics Laboratory (VGL) provides animal parentage verification, identification, forensics services, genetic diagnostics and genetic disease research as a self-supporting unit of the UC Davis School of Veterinary Medicine. The laboratory is internationally recognized as a pioneer and expert in DNA-based animal testing.

VGL also offers an extensive animal forensic services program, diagnostic tests for genetic diseases, and support for genetic research in domestic species, primates and wildlife.

William R. Pritchard Veterinary Medical Teaching Hospital

The William R. Pritchard Veterinary Medical Teaching Hospital provides cutting-edge equine care by board-certified experts in equine medicine and surgery at the most advanced and comprehensive veterinary hospital in the world.

INFECTIOUS DISEASE

Evaluation of Safety, Humoral Immune Response and Fecal Shedding of a Modified-Live Bovine Coronavirus Vaccine Given to Adult Healthy Horses. (Grant #14-16)

Investigators: James Prutton, DVM (Resident), Nicola Pusterla, DVM, Ph.D., DACVIM (Mentor) and Samantha Barnum, MS (Staff Research Associate)

Equine coronavirus is an emerging disease with a mortality rate of 7-27%. Investigating a vaccination protocol could allow for a reduction on the spread of equine coronavirus in the equine population.

How does this research benefit horses?

In this pilot study, 25% of horses vaccinated with modified live bovine coronavirus seroconverted, indicating an immune response was mounted in a subset of horses. The project demonstrated the safety of the bovine coronavirus vaccination in horses and demonstrated a limited immune response in certain individuals.

Use of Serum Amyloid A to Differentiate Between Infectious and Non-Infectious Diseases in Horses (Grant #14-14)

Investigators: Fiona Wensley, DVM (Resident), Nicola Pusterla, DVM, Ph.D., DACVIM (Mentor), Philip Kass, DVM, MPVM, MS, Ph.D. (Mentor), Danielle Carrade-Holt, Ph.D. (Research/Development Analyst), Julie Burges, MS (Clinical Diagnostic Lab Manager) and Kaitlyn James, Ph.D. (Graduate Student)

Serum amyloid A (SAA) is an acute phase protein that has been used in equine practice to assess and monitor horses for inflammation. The researchers in this study hypothesized that SAA alone, or in combination with white blood cell count and fibrinogen, would be a better indicator to differentiate infectious from non-infectious inflammatory disease. Horses were categorized by disease conditions as healthy, healthy vaccinated, inflammatory non-infectious (i.e. osteoarthritis, uveitis, laminitis, strangulating or ischemic colic), inflammatory infectious (i.e. abscess, cellulitis, sepsis) or non-infectious non-inflammatory non-healthy (i.e. neoplasia, Cushing's disease, non-strangulating colic cases such as impactions and enteroliths).

How does this research benefit horses?

In this study, SAA performance held a greater overall accuracy when compared to neutrophil count and fibrinogen, both individually and combined, for defining infectious versus non-infectious diseases. When used in conjunction with neutrophil count and fibrinogen, SAA further enhanced the accuracy of differentiating disease status. Use of this assessment tool by veterinarians would enhance their diagnostic evaluation and lead to a more accurate and rapid treatment plan for equine patients.

Effect of Valacyclovir (Anti-Viral) Treatment in an Equine Herpesvirus-5 (EHV-5) Related Lung Disease (Equine Multinodular Pulmonary Fibrosis) (Grant #15-33)

Investigators: Charlotte Easton-Jones, DVM (Resident), John Madigan, DVM, MS, DACVIM (Mentor), Nicola Pusterla, DVM, Ph.D., DACVIM (Mentor) and Samantha Barnum, MS (Staff Research Associate)

Recent studies have revealed that equine herpesvirus-5 (EHV-5) is commonly isolated from the lungs of horses diagnosed with Equine Multinodular Pulmonary Fibrosis (EMPF), suggesting that EHV-5 is linked and may be the cause of EMPF. The current theory is that the damage to the lungs from the viral infection may provide the health incident that the horse reacts to with an exaggerated inflammatory response. There are currently no studies assessing the impact of valacyclovir (anti-viral) treatment on the amounts of the virus, EHV-5, in EMPF cases. Researchers hypothesized that anti-viral therapy with valacyclovir will

lead to a decrease in the viral load of EHV-5 in whole blood, nasal secretions and bronchoalveolar lavage fluid of horses with EMPF.

How does this research benefit horses?

In this study of horses with naturally occurring EMPF treated with valacyclovir, there were no significant differences between the median EHV-5 viral load between day 0 and day 10 for all three of the sample types tested (blood, nasal secretions and bronchoalveolar lavage fluid). Treatment with valacyclovir did not appear to have a significant effect on EHV-5 viral load in EMPF affected horses. Therefore, while valacyclovir is a relatively expensive drug that is routinely used to treat horses with EMPF, this study revealed that 10 days of valacyclovir treatment did not significantly alter the viral amounts of EHV-5 in EMPF horses and therefore may not be a clinically effective treatment.

Do Imported Horses Represent a Significant Risk for the Spread of Respiratory Disease to Resident Equids in the United States? (Grant #14-12)

Investigators: Fauna Smith, DVM (Resident), Nicola Pusterla, DVM, Ph.D., DACVIM (Mentor), Johanna Watson, DVM, Ph.D., DACVIM (Mentor), Isabelle Kilcoyne, DVM, DACVS (Mentor) and Claudia Sonder, DVM (Mentor)

Imported horses are likely to be stressed during transport and may be at a higher risk of exposure to infectious respiratory pathogens, due to comingling with other horses at sales and shipping barns, during transport and at quarantine facilities. These horses may therefore represent a risk for spreading infectious respiratory pathogens into equine populations in the United States.

This study assessed the prevalence of respiratory disease in 166 horses entering the Contagious Equine Metritis quarantine facility at the UC Davis, Center for Equine Health between October 2014 and June 2016.

How does this research benefit horses?

Approximately 3.6% of horses were shedding either equine herpes virus 1 (EHV-1) or EHV-4, which could have serious consequences if introduced into a large barn. Equine influenza positive horses were not identified; however, many samples for influenza testing failed quality control. EHV-2 and -5 were commonly shed in imported horses. At this time, the significance of EHV-2 and -5 in the development of respiratory disease remains poorly understood.

While equine influenza was not identified in any sample, the two important implications from this study are that sampling technique and environmental conditions can affect the quality of the sample and due to the high failure rate it is possible to miss positive animals.

This research was reported in the *Journal of Veterinary Internal Medicine*. 2018 May 15. doi: 10.1111/jvim.15145.

MEDICINE

Assessing Plasma Concentrations Of 1.56% Diclazuril given Twice a Week to Adult Horses (Grant #14-15)

Investigators: Laszlo M. Hunyadi, DVM, MS, Ph.D. (Resident), Nicola Pusterla, DVM, Ph.D., DACVIM and Mark Papich, DVM, MS, DACVCP (Mentors)

EPM is a commonly diagnosed and economically costly neurologic disease affecting horses of all ages, but young performance horses appear to be at greater risk for developing this condition. Opossums are the definitive hosts of the major causative parasite, *Sarcocystis neurona*. The equine industry is in need of a preventive protocol that is both sustainable and cost effective.

The administration of a low dose diclazuril every 3 to 4 days was shown to be safe and caused no adverse effects in the study horses. Administration of diclazuril at the lower dose twice a week provided plasma concentrations to effectively inhibit *in vitro* concentrations for *Sarcocystis neurona*, a single celled parasite and the most common cause of EPM in horses in the United States.

How does this research benefit horses?

On ranches with a high incidence of EPM, the newly established protocol resulting from this study will improve compliance (twice weekly drug administration instead of daily drug administration) and reduce the total amount of diclazuril administered. Overall, this new protocol may reduce the negative effects associated with the use of compounded anti-protozoal drugs for the prevention of EPM.

Validation of a New Stall-side Test for Serum Amyloid A in Horses (Grant #15-31)

Investigators: Diana Schwartz, DVM (Resident), Nicola Pusterla, DVM, Ph.D., DACVIM (Mentor) and Mary Christopher, DVM, Ph.D. (Mentor)

Serum amyloid A (SAA) is an acute phase protein that has been used in equine practice to assess and monitor horses for inflammation. Validation of a stall-side SAA test in horses provides an opportunity for equine practitioners to rapidly and accurately identify abnormalities in SAA concentrations that can facilitate disease diagnosis, evaluate response to therapy, and assess overall prognosis in horses with a variety of inflammatory diseases.

How does this research benefit horses?

Based on the results of this study, the stall-side SAA test should be accurate for use by veterinarians to detect inflammation in horses, but with less precision at high concentrations if performing serial measurements between batches. Interpretation of SAA results obtained using this stall-side test and other SAA laboratory tests should be undertaken with acknowledgment of differences in results between methods and between test kit batches.

Levels of a Heart Muscle Damage Marker (Cardiac Troponin) in Healthy Neonatal Thoroughbred Foals and Thoroughbred Foals with Rib Fractures (Grant #14-11)

Investigators: Rana Bozorgmanesh, B.Sc., BVetMed, DACVIM, MRCVS, (Resident), Gary Magdesian, DVM, DACVIM, DACVECC, DACVCP (Mentor), Nathan M. Slovis DVM, DACVIM, CHT (Collaborator), Jeanne Bowers-Lepore, DVM (Collaborator)

Rib fractures sustained during birth are not uncommon injuries in neonatal foals. In some foals, they can have severe effects including death from heart or lung damage. Prompt identification and assessment of rib fractures are necessary to determine if surgical management is warranted. Thoracic ultrasound is most commonly used to identify fractured ribs, but requires expertise and is time-consuming. Therefore, a quick and cost-effective method of identification of potentially fatal rib fractures would be a valuable clinical aid for the equine veterinarian.

How does this research benefit horses?

In this study, cardiac troponin was determined to not be a specific indicator of rib fractures. This may be due to a low rate of direct damage to the heart muscle in foals in this study and the mortality rate for foals with rib fractures was lower than previously reported. Potential reasons for the low mortality include increased awareness, earlier identification, or improved management of rib fractures.

Temporal Variability in Serum Glucose and Insulin Concentrations in Neonatal Foals (Grant #14-13)

Investigators: Emily Berryhill, DVM, DACVIM (Resident), Gary Magdesian, DVM, DACVIM, DACVECC, DACVCP (Mentor) and Judy Edman, BS (Staff Research Associate)

Insulin dynamics are associated with metabolic diseases such as Equine Metabolic Syndrome and insulin resistance. It is well established that serum glucose and insulin concentrations in adult horses and foals are affected by many variables, including feed intake, stress, and metabolic phenotype. However, there are no studies that serially measure insulin and glucose concentrations in healthy foals of differing ages to establish normal daily variability, how insulin and glucose are associated with other metabolic parameters (i.e. serum triglycerides), and how they change with age. The researchers in this study hypothesized that newborn foals have highly variable serum glucose and insulin concentrations compared to adult horses.

How does this research benefit horses?

The study confirmed the hypothesis that serum glucose and insulin concentrations in neonatal foals of different ages can have a high degree of variation when measured serially over several hours. For instance, the maximum serum insulin concentration over a 16-hour sampling period was almost double that of the lowest insulin concentration for individual foals at all ages analyzed.

Documenting and understanding insulin and glucose dynamics in healthy foals is imperative to understanding metabolic changes that occur with critical illness, including insulin resistance secondary to neonatal infection, and may influence treatment of sick foals.

SURGERY, LAMENESS AND IMAGING

Jaw Joint Arthritis in Horses: Comparison of Advanced Imaging with Gross and Microscopic Findings (Grant #15-35)

Investigators: Jacqueline Tanner, DVM, MS, DACVR (Resident), Derek Cissell, VMD, Ph.D., DACVR (Mentor), Boaz Arzi, DVM, DAVDC, DEVDC (Mentor)

Temporomandibular joint (i.e., jaw joint or TMJ) arthritis in the horse is poorly understood and difficult to diagnose using conventional imaging techniques such as radiographs. Interest in advanced imaging to evaluate the TMJ has been growing; although up to 25% of horses are suspected to have evidence of TMJ arthritis on advanced imaging exams, very little has been published regarding the significance of these findings. Furthermore, there are no descriptions of abnormal advanced imaging findings in the TMJ and their relationship to TMJ arthritis.

Advanced imaging through computed tomography (CT), gross examination, and microscopic examination of the jaw joints of 18 deceased adult horses of varying ages were performed. CT images were scored for evidence of arthritis. These scores were compared to gross and microscopic evaluation of the jaw joints to confirm the presence of arthritis.

How does this research benefit horses?

Advanced imaging through CT showed abnormalities that correlated strongly with evidence of arthritis in the postmortem examinations of adult horses of varying ages. Jaw joint arthritis has been proposed as a cause of reduced performance and behavior problems in horses. This study establishes advanced imaging findings through CT associated with jaw joint arthritis, providing a foundation for predicting clinically significant jaw joint arthritis. This will help identify patients that may benefit from treatment of the jaw joint to restore or improve performance.

Characterizing Equine Odontoclastic Tooth Resorption and Hypercementosis (EOTRH) Lesions through Radiographic and Histological Methods. (Grant #15-29)

Investigators: Amanda L. Johnson, DVM, MPH (Resident), Travis J, Henry, DVM (Mentor), Brian G. Murphy, DVM, Ph.D., DACVP (Mentor), Verena K. Affolter, DVM, Ph.D., DECVP (Mentor)

Equine odontoclastic tooth resorption and hypercementosis (EOTRH) is a commonly recognized, but poorly characterized disease in middle-aged and older horses. The underlying cause remains elusive, and at present, the only therapeutic option is surgical extraction of affected teeth. Loss of incisor teeth can have a negative impact on athletic performance as well as the ability to grasp food material. The goal of this study was to identify microscopic changes in teeth and paradental tissues characteristic of EOTRH that relate to specific radiographic changes. An improved understanding of the pathogenesis of EOTRH may aid in the development of future treatments.

The study evaluated tissues and radiographic evidence of equine odontoclastic tooth resorption and hypercementosis as well as the affected tooth, adjacent teeth and surrounding bone and soft tissue structures.

How does this research benefit horses?

The data collected demonstrated the histopathologic features of EOTRH and information was gained in how to process tissues to avoid loss of cellular detail. To avoid loss of cellular detail associated with decalcification of tissue, future studies should focus on acrylic embedding of tissues, which allows processing and staining of hard tissues without decalcification. This study additionally provided preliminary data for a larger scale project on EOTRH. A greater understanding of the underlying mechanisms of EOTRH could provide the ability to sustain a full complement of incisor teeth in the older horse, and may provide a path forward to novel treatment strategies.

Comparison of Duration of Target Intra-Articular Concentrations Following Intravenous Regional Limb Perfusion with Two Doses of Amikacin Sulfate in Horses (Grant #14-10)

Investigators: Alison Harvey, BVSc MRCVS, Isabelle Kilcoyne, MVB DACVS (Resident), Barbara A. Byrne, DVM Ph.D., DACVIM, DACVM and Jorge Nieto, MVZ Ph.D. DACVS, DACVSMR (Mentors)

Traumatic wounds in the limbs of horses are common and frequently involve synovial (joint) structures that can affect the life and athletic career of the horse. Intravenous regional limb perfusion (IVRLP) with antibiotics is a simple procedure, which allows effective levels of antibiotics to be administered locally with minimal systemic effects.

To date, there is limited information available on the duration of targeted antibiotic concentrations within joints following IVRLP with amikacin, and how this is affected by the dose used. Determining the length of time that antibiotic concentrations remain above adequate protective levels based on hospital-established minimum inhibitory concentrations (MICs) would guide clinical decisions on the appropriate dosage and frequency of treatment for horses with synovial sepsis, and potentially reducing the frequency of treatment and incidence of unwanted side effects. Study results showed that a 2 gram dose of amikacin, administered through IVRLP, is likely appropriate for most injuries. A 3 gram dose is feasible but may not be justified in the majority of distal limb injuries and should be reserved for cases where culture and sensitivity of the bacterial infections reveals MICs above those achievable with a routine dose range

How does this research benefit horses?

The study results will guide veterinary decisions on use of the antibiotic amikacin for treatment of wound infections in joints and reduce the use of more antibiotic than is productive. For most infectious conditions, a daily IVRLP 2 gram dose will be sufficient. There were no adverse effects noted using either dose.

Evaluation of 10 Minute vs. 30 Minute Tourniquet Time for Intravenous Regional Limb Perfusion (IVRLP) with Amikacin Sulfate in Standing Sedated Horses (Grant #13-16)

Investigators: Isabelle Kilcoyne, MVB, DACVS (Resident), Julie E. Dechant, DVM, MS, DACVS, DACVECC and Jorge E. Nieto, MVZ, Ph.D., DACVS, DACVSMR (Mentors)

To address traumatic wounds in the limbs of horses involving synovial structures in a joint, veterinarians often administer 2 grams of amikacin in 60 mL of 0.9% Saline, which allows effective levels of antibiotics to be administered locally with minimal systemic effects. Tourniquets have been used on the distal limb of horses undergoing surgery to maintain a bloodless surgical field for up to 1-2 hours with minimal adverse effects being reported. When performing IVRLP to deliver antibiotics locally, tourniquet times of up to 25-30 minutes have been reported in previous studies. Use of a shorter tourniquet time could greatly reduce the discomfort experienced by the horse and the level of sedation required to perform the procedure in the standing animal.

How does this research benefit horses?

The study showed that there was no significant difference between the synovial amikacin concentrations noted between 10 minute and 30 minute IVRLP. Based on

these results, 10 minute tourniquet time may be sufficient to achieve peak synovial amikacin concentrations when performing IVRLP.

To further investigate the actual time required to reach peak synovial concentrations of antibiotics during intravenous regional limb perfusion the group performed a second study in which samples of joint fluid were taken every five minutes after the IVRLP was performed. This study demonstrated the time to reach peak concentrations within the joint was 15 minutes, thereby only necessitating tourniquet application for 15 minutes.

REPRODUCTION

Effect of local anesthetic (lidocaine) on the quality of semen collected from the testicles of castrated stallions (Grant #15-32)

Investigators: Jenny Boye, DVM, DACT (Resident) and Bruce Christensen, DVM, MS, DACT (Mentor)

Sperm from castrated horses can be saved, if the testicles and epididymides (ducts that help to store sperm) are processed after they are removed from the stallion. During this procedure, the sperm is frozen and stored for future insemination. Castration surgery can be performed with or without the local pain medicine injected into the testicles, when the horse is under general anesthesia. Lidocaine is the most commonly used drug for local pain relief during castration. The standard dose typically used in a routine castration is 10mls of Lidocaine 2% in each testicle.

If the sperm is to be harvested, however, the castration is often performed without lidocaine due to concern that the local pain medicine may affect the sperm quality. There is, however, no published evidence that shows any effect of lidocaine on equine sperm quality, fertility, or demonstrates actual contact between the lidocaine and the sperm. The project sought to determine the effect of lidocaine exposure on sperm quality, determine if there are measurable amounts of lidocaine in the sperm, when the lidocaine is injected into the testicles, and determine what the amount is; and determine if castration with lidocaine affects quality of sperm saved from the epididymis after castration, freezing and thawing.

How does this research benefit horses?

During the *in vitro* study there was no significant difference for any of the measured motility parameters for lidocaine concentrations at low concentrations (1-10 µg/ml) compared with the lidocaine-free control sample. There were significant decreases in motility parameters in samples with high and very high lidocaine concentrations (100 µg/ml - 10,000 µg/ml) compared to the lidocaine-free control sample. Morphology was not affected by lidocaine at any concentration and membrane permeability was only affected at the highest concentration of lidocaine (10,000 µg/ml).

After castration, an average concentration of 1.027 ± 0.422 µg /ml lidocaine was detected in the epididymal flush of stallions treated with lidocaine during surgery. There was no effect in sperm quality parameters in sperm obtained from testicles with the use of lidocaine compared with the ones without the lidocaine during castration.

Based on these results, it should be considered safe to castrate a stallion with local anesthesia injected into the testicle before castration if an epididymal flush is intended post-castration. This would allow veterinarians to perform castrations with lower levels of pain as well as reducing the need of higher amounts of general anesthetic and pain medication post-surgery.

DRUG THERAPIES


RESEARCH PAPER

Pharmacokinetics and pharmacodynamics of intravenous romifidine and propranolol administered alone or in combination for equine sedation

Pharmacokinetics and pharmacodynamics of intravenous romifidine and propranolol administered alone or in combination for equine sedation

Vet Anaesth Analg. 2017 Jan;44(1):86-97)


Desflurane and sevoflurane elimination kinetics and recovery quality in horses

Desflurane and sevoflurane elimination kinetics and recovery quality in horses

Am J Vet Res. 2015 Mar;76(3):201-7)


Pharmacokinetics and physiological effects of repeated oral administrations of tramadol in horses

J Vet Pharmacol Ther. 2014 Jun;37(3):269-78)


Equine Veterinary Journal

Soluble epoxide hydrolase activity and pharmacologic inhibition in horses with chronic severe laminitis

Soluble epoxide hydrolase activity and pharmacologic inhibition in horses with chronic severe laminitis

Equine Vet J. 2017 May;49(3):345-351.)


Pharmacokinetics of metronidazole in foals: influence of age within the neonatal period

Pharmacokinetics of metronidazole in foals: influence of age within the neonatal period

J Vet Pharmacol Ther. 2015 Jun;38(3):227-34)


Pharmacokinetics and physiological effects of repeated oral administrations of tramadol in horses

Pharmacokinetics and antinociceptive effects of the soluble epoxide hydrolase inhibitor t-TUCB in horses with experimentally induced radiocarpal synovitis

J Vet Pharmacol Ther. 2018 Apr;41(2):230-238)

Continued on page 34

Toxoplasma gondii seroprevalence and association with equine protozoal myeloencephalitis: A case-control study of Californian horses.

James KE, Smith WA, Packham AE, Conrad PA, Pusterla N

Veterinary Journal 2017 Jun; 224:38-43

While toxoplasmosis is not commonly considered a clinical disease of equines, previous seroprevalence studies have reported differing background rates of *Toxoplasma gondii* infection in horses globally. The objective of this study was to evaluate possible associations between *T. gondii* seroprevalence and clinical signs of equine protozoal myeloencephalitis (EPM) in horses. Using a case-control study design, 720 Californian horses with neurologic signs compatible with EPM were compared to healthy, non-neurologic horses for the presence of *T. gondii* antibodies (using indirect fluorescent antibody tests [IFAT]). *Toxoplasma gondii* seroprevalence among cases and controls was determined at standard serum cut-offs: 40, 80, 160, 320, and 640. At a *T. gondii* titre cut-off of 320, horses with clinical signs compatible with EPM had 3.55 times the odds of a seropositive test compared to those without clinical signs (P<0.01) when adjusted for covariates. When restricted to the autumn season and at the same titre cut-off, an EPM suspect horse had 6.4 times the odds of testing seropositive to *T. gondii*, compared to non-neurologic horses. The association between high *T. gondii* titres and clinical signs compatible with EPM is potentially reflective of toxoplasmosis in equines. Serologic testing of cerebrospinal fluid and isolation of *T. gondii* in EPM suspect cases should be considered. Future studies investigating the relationship between *T. gondii* and EPM are warranted.

Table 1. Prevalence of *Toxoplasma gondii* serum titres in case horses with neurological signs compatible with equine protozoal myeloencephalitis (n = 392) and control horses with no neurological signs (n = 328), and *Toxoplasma gondii* titre odds ratios (OR) associated with case status at various serum titre cut-offs.

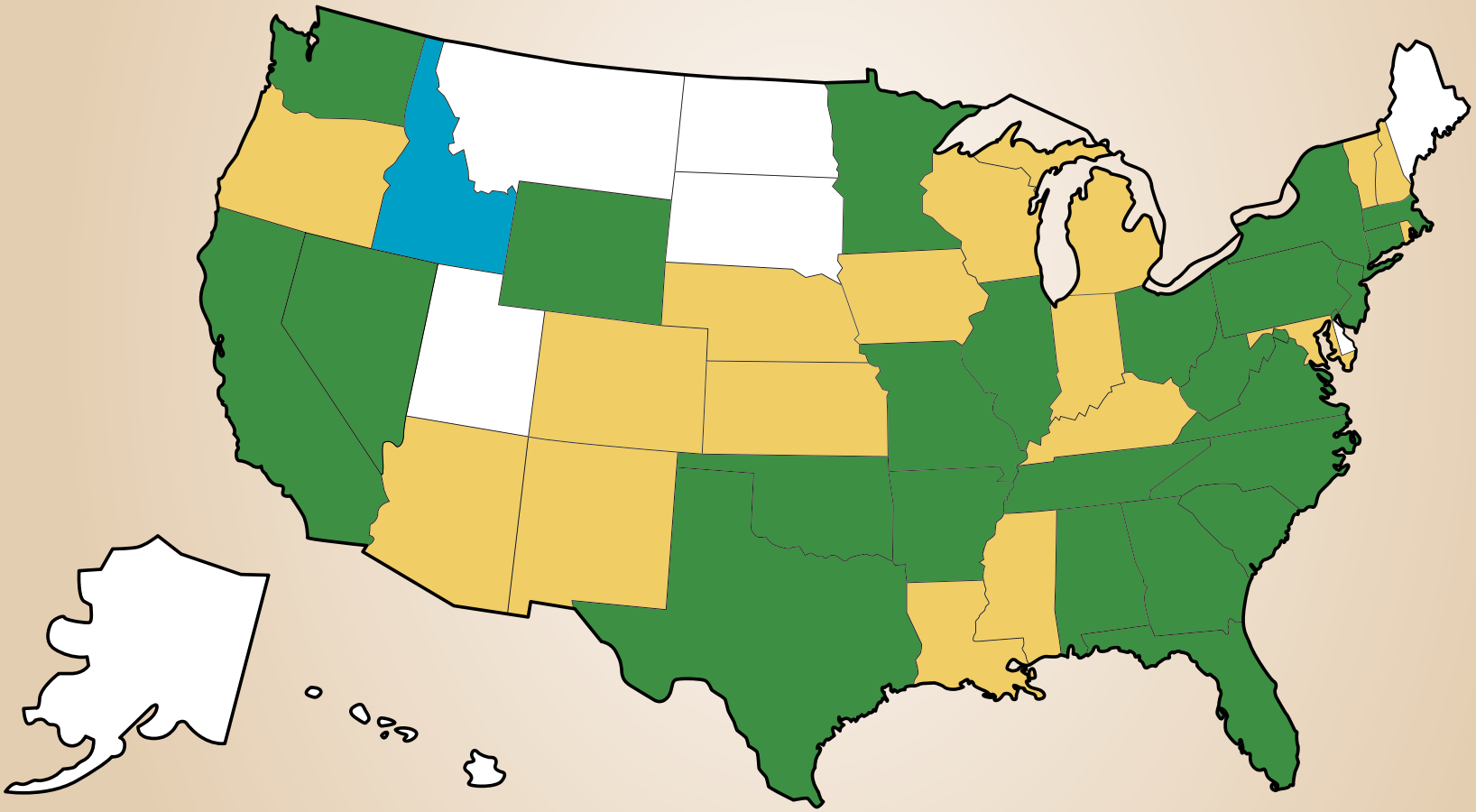
Toxoplasma gondii serum titre	Prevalence	≥OR titre (95% confidence intervals)	*Toxoplasma gondii* serum titre	Prevalence
	Case	Control	Unadjusted OR	Adjusted[a] OR
40	241 (62%)	239 (73%)	0.59[b] (0.43–0.83)	0.89 (0.58–1.38)
80	121 (31%)	107 (33%)	0.92 (0.66–1.28)	1.52 (0.96–2.44)
160	78 (20%)	54 (16%)	1.26 (0.84–1.89)	1.77 (0.98–3.22)
320	49 (13%)	16 (5%)	2.7[b] (1.52–5.35)	3.55[b] (1.4-9.0)
640	18 (5%)	5 (2%)	3.10[b] (1.10–10.8)	4.12 (0.70–24.6)

[a] Adjusted for statistically significant covariates (P < 0.05): age, breed, Sarcocystis neurona serum titre ≥40, and Neospora hughesi serum titre ≥160.
[b] P < 0.01.

Table 2. Seasonally restricted prevalence of *Toxoplasma gondii* serum titres in case horses with neurological signs compatible with equine protozoal myeloencephalitis (n = 392) and control horses with no neurological signs (n = 328), and T. gondii titre odds ratios (OR) associated with case status at various serum titre cut-offs.

Toxoplasma gondii serum titre	Prevalence	≥OR titre (95% confidence intervals)	*Toxoplasma gondii* serum titre	Prevalence
	Case	Control	Unadjusted OR	Adjusted[a] OR
40	90 (65%)	239 (73%)	0.68 (0.43–1.08)	1.20 (0.67–2.08)
80	52 (37%)	107 (33%)	1.23 (0.80–1.90)	2.15[d] (1.21–3.82)
160	35 (25%)	54 (16%)	1.71[c] (1.02–2.83)	2.79[d] (1.38–5.63)
320	24 (17%)	16 (5%)	4.07[d] (1.98–8.48)	6.40[d] (2.27–18.0)
640	7 (5%)	5 (2%)	3.43[c] (0.91–14.0)	6.53 (0.92–46.4)

[a] Only horses sampled from California in August–November, 2013 were included in the analysis.
[b] Adjusted for statistically significant covariates (P < 0.05): age, breed, *Sarcocystis neurona* serum titre ≥40, and *Neospora hughesi* serum titre ≥160.
[c] P < 0.05.
[d] P < 0.01.



UCDAVIS VETERINARY MEDICINE

DRUG THERAPIES

Continued

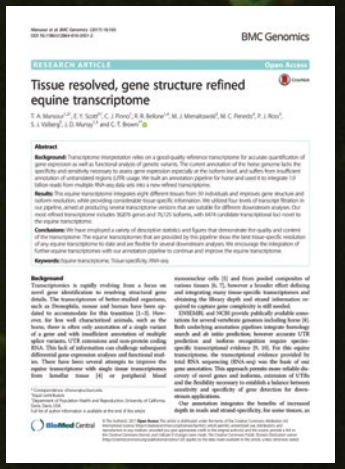

Effect of Dose on Intra-Articular Amikacin Sulfate Concentrations Following Intravenous Regional Limb Perfusion in Horses

Vet Surg. 2016 Nov;45(8):1077-1082)

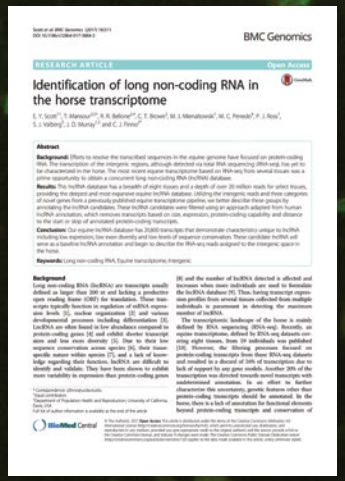
GENETICS


Investigation of Known Genetic Mutations of Arabian Horses in Egyptian Arabian Foals with Juvenile Idiopathic Epilepsy

J Vet Intern Med. 2018 Jan;32(1):465-468)


Tissue resolved, gene structure refined equine transcriptome

BMC Genomics. 2017 Jan 20;18(1):103)


Identification of long non-coding RNA in the horse transcriptome

BMC Genomics. 2017 Jul 4;18(1):511)


Transcriptome profiling of equine vitamin E deficient neuroaxonal dystrophy identifies upregulation of liver X receptor target genes

Free Radic Biol Med. 2016 Dec;101:261-271)


Journal of Veterinary Internal Medicine

Blood and Cerebrospinal Fluid α-Tocopherol and Selenium Concentrations in Neonatal Foals with Neuroaxonal Dystrophy

C.J. Finno, K.E. Estell, S. Katzman, L. Wenholz, A. Rendahl, J. Tretter, D.L. Rannucci, and B. Puschner

Blood and Cerebrospinal Fluid α-Tocopherol and Selenium Concentrations in Neonatal Foals with Neuroaxonal Dystrophy

J Vet Intern Med. 2015 Nov-Dec;29(6):1667-75)


The Veterinary Journal

Risk of false positive genetic associations in complex traits with underlying population structure: A case study

Carrie J. Finno, Monica Aleman, Robert J. Higgins, John E. Madigan, Danika L. Bannasch

Risk of false positive genetic associations in complex traits with underlying population structure: a case study

Vet J. 2014 Dec;202(3):543-9)


Limbal squamous cell carcinoma in Haflinger horses

Limbal Squamous Cell Carcinoma in Haflinger Horses


PLOS | GENETICS

SERPINB11 Frameshift Variant Associated with Novel Hoof Specific Phenotype in Connemara Ponies

SERPINB11 frameshift variant associated with novel hoof specific phenotype in Connemara ponies

PLoS Genet. 2015 Apr 13;11(4):e1005122)


RNA-Seq Transcriptome Profiling of Equine Inner Cell Mass and Trophectoderm

RNA-seq transcriptome profiling of equine inner cell mass and trophectoderm

Biol Reprod. 2014 Mar 20;90(3):61)

MEDICINE and INFECTIOUS DISEASE


Short communication

Comparison of flocked and rayon swabs for the molecular detection of selected equine viruses and bacteria from nasal secretions of healthy horses

Nicola Pusterla, Samantha Barnum, Kirsten Kenelty

Comparison of flocked and rayon swabs for the molecular detection of selected equine viruses and bacteria from nasal secretions of healthy horses

Vet Rec. 2017 Aug 19;181(8):197)


Journal of Veterinary Internal Medicine

Qualitative and Quantitative Characteristics of the Electroencephalogram in Normal Horses during Administration of Inhaled Anesthesia

D.C. Williams, R.J. Brosnan, D.J. Fletcher, M. Aleman, T.A. Holliday, B. Tharp, P.H. Kass, R.A. LaCouteur, and E.P. Steffey

Qualitative and Quantitative Characteristics of the Electroencephalogram in Normal Horses during Administration of Inhaled Anesthesia

J Vet Intern Med. 2016 Jan-Feb;30(1):289-303)


Journal of Veterinary Internal Medicine

Association of Factor V Secretion with Protein Kinase B Signaling in Platelets from Horses with Atypical Equine Thrombasthenia

J.W. Norris, M. Pontbo, E. Shirley, G. Blevins, and F. Tablin

Association of Factor V Secretion with Protein Kinase B Signaling in Platelets from Horses with Atypical Equine Thrombasthenia

J Vet Intern Med. 2015 Sep-Oct;29(5):1387-94)


Check for updates

Brief Communication

Development of an equine coronavirus-specific enzyme-linked immunosorbent assay to determine serologic responses in naturally infected horses

Lotte J. Kooijman, Samantha M. Mapes, Nicola Pusterla

Development of an equine coronavirus-specific enzyme-linked immunosorbent assay to determine serologic responses in naturally infected horses

J Vet Diagn Invest. 2016 Jul;28(4):414-8)


The Veterinary Journal

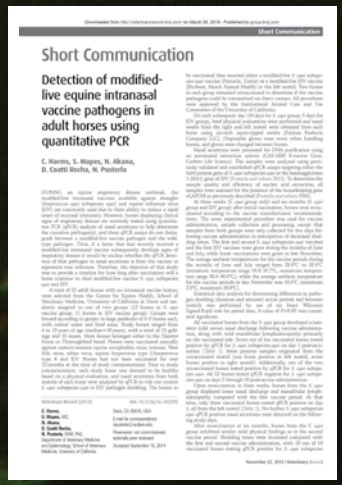
Short Communication

Daily feeding of diclazuril top dress pellets in foals reduces seroconversion to Sarcocystis neurona

Nicola Pusterla, Andrea Packham, Sarah Mackie, Philip H. Kass, Laszlo Hunyadi, Patricia A. Conrad

Daily feeding of diclazuril top dress pellets in foals reduces seroconversion to Sarcocystis neurona

Vet J. 2015 Nov;206(2):236-8)


Short Communication

Detection of modified-live equine intranasal vaccine pathogens in adult horses using quantitative PCR

C. Harms, S. Mapes, M. Akana, D. Coutts Rocha, N. Pusterla

Detection of modified-live equine intranasal vaccine pathogens in adult horses using quantitative PCR

Vet Rec. 2014 Nov 22;175(20):510)


Journal of Veterinary Internal Medicine

Electroencephalogram of Healthy Horses During Inhaled Anesthesia

D.C. Williams, M.R. Aleman, R.J. Brosnan, D.J. Fletcher, T.A. Holliday*, B. Tharp, P.H. Kass, F.P. Steffey, and R.A. LeCouteur

Electroencephalogram of Healthy Horses During Inhaled Anesthesia

J Vet Intern Med. 2016 Jan-Feb;30(1):304-8)


The Veterinary Journal

Short Communication

Field use of N-butylscopolammonium bromide to facilitate thorough ophthalmic examination in horses

J. Palmero*, S. Hollingsworth, P. Kass, S. Moore, N. Pusterla

Field use of N-butylscopolammonium bromide to facilitate thorough ophthalmic examination in horses (10-06)

Vet J. 2016 May;211:104-5)

ORTHOPEDICS and LAMENESS

F-sodium fluoride positron emission tomography of the equine distal limb: Exploratory study in three horses

Equine Vet J. 2018 Jan;50(1):125-132)

Hitting the ground running: Evaluating an integrated racehorse limb and race surface computational model

J Biomech. 2016 Jun 14;49(9):1711-1717)

Positron emission tomography of the equine distal limb: exploratory study

Vet Radiol Ultrasound. 2016 Nov;57(6):630-638)

Modelling the effect of race surface and racehorse limb parameters on in silico fetlock motion and propensity for injury

Equine Vet J. 2017 Sep;49(5):681-687)

Diagnostic approach to catastrophic musculoskeletal injuries in racehorses

J Vet Diagn Invest. 2017 Jul;29(4):405-413)

Prevalence, location and symmetry of noncatastrophic ligamentous suspensory apparatus lesions in California Thoroughbred racehorses, and association of these lesions with catastrophic injuries

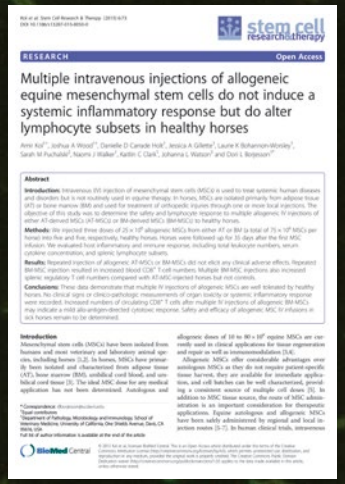
Equine Vet J. 2016 Jan;48(1):27-32)

REGENERATIVE MEDICINE


Stem Cells Translational Medicine

Allogeneic Stem Cells Alter Gene Expression and Improve Healing of Distal Limb Wounds in Horses

Stem Cells Transl Med. 2018 Jan;7(1):98-108)


stem cell research therapy

Multiple intravenous injections of allogeneic equine mesenchymal stem cells do not induce a systemic inflammatory response but do alter lymphocyte subsets in healthy horses

Stem Cell Res Ther. 2015 Apr 15;6:73)


Stem Cells and Development

Equine Mesenchymal Stem Cells Inhibit T Cell Proliferation Through Different Mechanisms Depending on Tissue Source

Stem Cells Dev. 2014 Jun 1;23(11):1258-65)


Hindawi

Research Article

Allogeneic Mesenchymal Stem Cell Treatment Induces Specific Alloantibodies in Horses

Stem Cells Int. 2016;2016:5830103)


Ultrastructure and growth factor content of equine platelet-rich fibrin gels

Am J Vet Res. 2014 Apr;75(4):392-401)


Equine Veterinary Journal

Scintigraphic comparison of intra-arterial injection and distal intravenous regional limb perfusion for administration of mesenchymal stem cells to the equine foot

Equine Vet J. 2014 Jul;46(4):479-83)

REGENERATIVE MEDICINE

Continued

Scintigraphic Tracking of Allogeneic Mesenchymal Stem Cells in the Distal Limb After Intra-Arterial Injection in Standing Horses

Pablo Espinosa, Mathieu Spriet, Albert Sole, Naomi J. Walker, Betsy Vaughan, and Larry D. Galuppo

Scintigraphic Tracking of Allogeneic Mesenchymal Stem Cells in the Distal Limb After Intra-Arterial Injection in Standing Horses

Vet Surg. 2016 Jul;45(5):619-2)

Equine Veterinary Journal

Ultrasound-guided injection of the median artery in the standing sedated horse

M. SPRIET*, J. M. TRELA* and L. D. GALUPPO

Ultrasound-guided injection of the median artery in the standing sedated horse

Equine Vet J. 2015 Mar;47(2):245-8)

SURGERY

ORIGINAL ARTICLE

A novel ultrasonographic assisted technique for desmotomy of the palmar/plantar annular ligament in horses

Pablo Espinosa, DVM† | Jorge E. Nieto, DVM, PhD, DACVS‡ | Jack R. Snyder, DVM, PhD, DACVS‡ | Larry D. Galuppo, DVM, DACVS‡ | Scott A. Katzman, DVM, DACVS‡

A novel ultrasonographic assisted technique for desmotomy of the palmar/plantar annular ligament in horses

Vet Surg. 2017 Jul;46(5):611-620)

A Nonterminal Equine Mandibular Model of Bone Healing

Tiffany L. Servalian, DVM, Tanya C. Garcia, MS, Erin E. Dienes, MS, Brian Murphy, DVM, PhD, Diplomate ACVP, Susan M. Stover, DVM, PhD, Diplomate ACVS, and Larry D. Galuppo, DVM, Diplomate ACVS

A nonterminal equine mandibular model of bone healing

Vet Surg. 2015 Apr;44(3):314-21)

Allogeneic Stem Cells Alter Gene Expression and Improve Healing of Distal Limb Wounds in Horses

Textor JA, Clark KC, Walker NJ, Aristizobal FA, Kol A, LeJeune SS, Bledsoe A, Davidyan A, Gray SN, Bohannon-Worsley LK, Woolard KD, Borjesson DL.

Stem Cells Translational Medicine 2018 Jan; 7(1):98-108.

Distal extremity wounds are a significant clinical problem in horses and humans and may benefit from mesenchymal stem (MSC) therapy. This study evaluated the effects of direct wound treatment with allogeneic stem cells. This study provides evidence that MSC therapy shows promise for distal extremity wounds in horses, particularly when applied by direct injection into the wound margin. Interestingly, hypoxic preconditioning did not offer an advantage in this study. These findings in a horse model may be directly applicable to chronic wound studies in human patients, and provide insights to cellular based approaches of treatment.

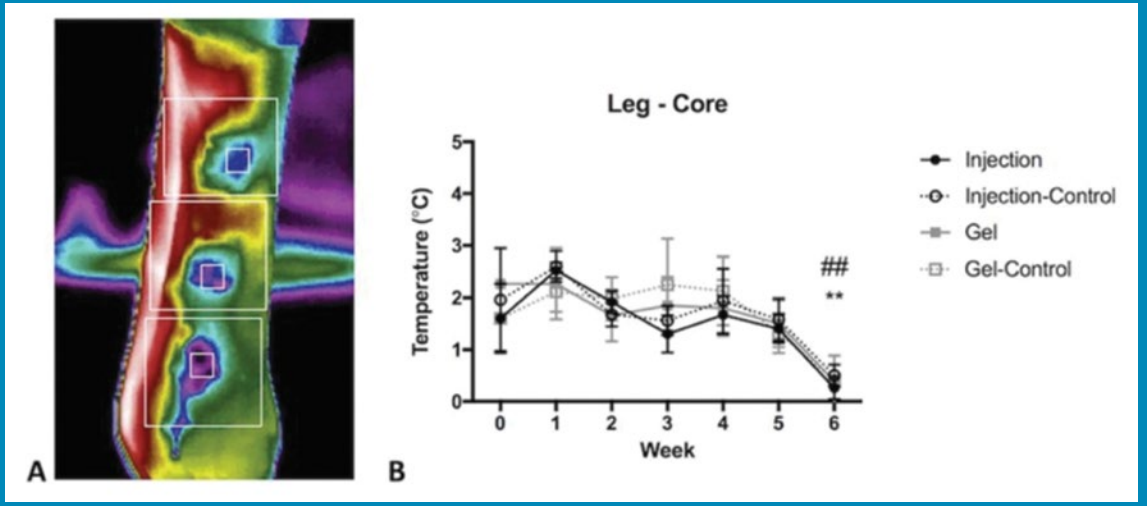


Figure A. Thermographic data were analyzed according to core wound temperature (small square gates centered on wounds) and overall leg temperature (larger square gates).

Figure B. A significant effect of time was detected for all treatment groups. By six weeks, the difference between core wound and surrounding leg temperature is nearly zero, that is, temperature of the wound bed has normalized. There was a significant decrease of temperature variation in wounds treated with mesenchymal stem cell (MSC) embedded gels and injected MSC's at Week 6.

Data are displayed as mean (SE). Week 0 data was collected on day 1 of wound, prior to treatment application.

NEWLY FUNDED Research Studies

- Evaluating the contribution of arena surface properties to joint angles and tendon and ligament strains in the equine forelimb while jumping
- Validation of putative genetic variants for equine neuroaxonal dystrophy
- Using microbiota analyses to understand foal health: an examination of mare's milk and the foal microbiota
- Establishing the relationship between training and racing schedules and proximal sesamoid bone microdamage and porosity for future use in the prediction of bone fracture and fetlock breakdown in Thoroughbred racehorses
- Serological response to equine influenza virus following boost vaccination of adult horses using different commercially available killed vaccines
- Comparison of 18f-fluofide, 18f-FDG and combined 18f-Fluoride/ 18f-FDG PET/CT scans for evaluation of the equine foot
- The effect of horseshoe length on hoof growth, hoof horn tubule orientation and hoof wall angles
- Determining genetic alterations associated with melanoma in graying connemara ponies
- Validation of putative genetic variants for juvenile idiopathic epilepsy in arabian horses
- Temporal and spatial phylogeny of H3N8 equine influenza virus in the USA (2006-2016)
- Efficacy and safety of flavopiridol for preventing post-traumatic osteoarthritis of horses
- Investigating genetic risk loci for ocular squamous cell carcinoma in horses

- Comparison of flocked and rayon swabs for the molecular detection of selected equine viruses and bacteria from nasal secretions of healthy horses
- Genetic investigation of idiopathic persistent hypocalcemia in the Thoroughbred
- Investigating the genetic diversity of EHV-5 in healthy horses, horses with upper airway disease and horses with multinodular pulmonary fibrosis
- Interrogate blood mononuclear cells from horses with and without equine protozoal myeloencephalitis in order to document recent infection with Sarcocystis neurona
- Peptide based ELISA to elucidate the involvement of several protozoan parasites in Equine Protozoal Myeloencephalitis
- Plasma and synovial fluid concentrations and cartilage toxicity of bupivacaine intra-articular administration
- Can anesthesia be induced by intravenous etomidate in horses?
- Biomarker in equine neurodegenerative diseases
- Effect of non-steroidal anti-inflammatory drugs and anti-histamines on serum amyloid
- ECA19 - functional variants associated with bilateral corneal stromal loss in Friesian horses
- *In vitro* efficacy of a polyhexamethylene biguanide-impregnated gauze dressing against common bacteria found in horses

Positron Emission Tomography of the Equine Distal Limb: Exploratory Study

Mathieu Spriet, Pablo Espinosa, Andre Z. Kyme, Pavel Stepanov, Val Zavarzin, Stephen Schaeffer, Scott A. Katzman, Larry D. Galuppo, David Beylin

Veterinary Radiology and Ultrasound. 2016 Nov; 57(6):630-638

Positron emission tomography (PET) is a highly sensitive, noninvasive imaging technique for quantifying biological functions of tissues. However, at the time of this study, PET imaging applications had not been reported in the horse. The aim of this exploratory study was to determine whether a portable high-resolution PET scanner could be used to image the equine distal limb. Images of the front feet and fetlocks of three research horses, with known lesions localized to the distal front limbs, were acquired under general anesthesia after administration of ^{18}F-fluorodeoxyglucose (^{18}F-FDG), with doses ranging from 1.5 to 2.9 MBq/kg. The radiation exposure measured during imaging was slightly higher than ^{99m}Technetium scintigraphy. However, the use of general anesthesia allowed the proximity and the contact time with the patient to be minimized for the staff involved. ^{18}F-FDG uptake was evident throughout the soft tissues, with the highest uptake in the coronary band and the lowest uptake in the tendons. Anatomic structures could be discriminated due to the high contrast between soft tissue and bone. Detected lesions included lysis of the flexor cortex of the navicular bone, lesions of flexor tendons and suspensory ligament, and abnormal uptake through the lamina of a laminitic subject. Findings indicated that tomographic molecular imaging is feasible in the equine distal limb and could be useful as a future diagnostic technique for clinical and research studies, especially those involving tendinopathy/desmopathy and laminitis.

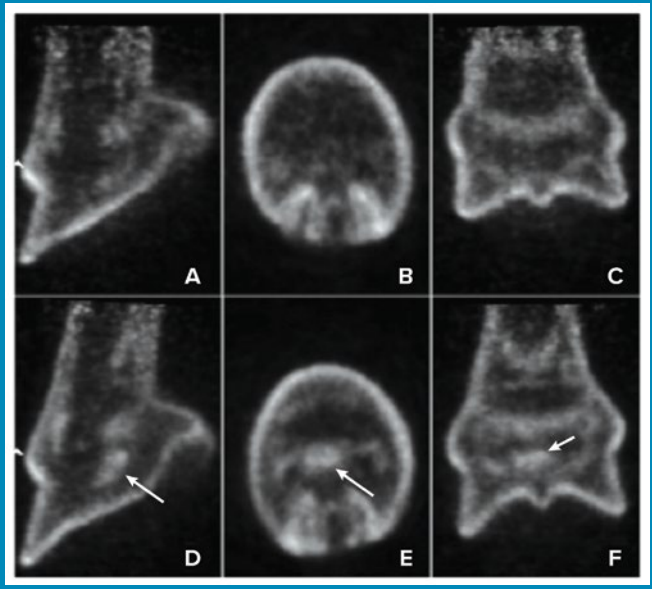


Figure 1

^{18}F-FDG PET images of both front feet (right top row, left bottom row) of a 15-year-old Quarter Horse mare with known chronic degenerative changes of the left front navicular bone. Sagittal (A and D), transverse (B and E), and dorsal images (C and F) are presented. ^{18}F-FDG uptake is identified throughout the soft tissue while the normal bones do not present any visible uptake. The coronary band presents the strongest uptake (arrow heads). The hoof lamina, subcutaneous tissue, and synovium present moderate uptake. Low uptake is present within the tendon. The anatomy can be recognized based on the contrast between soft tissue and bone. The arrows in the bottom row show marked increased ^{18}F-FDG uptake in the palmar central part of the navicular bone (arrows).

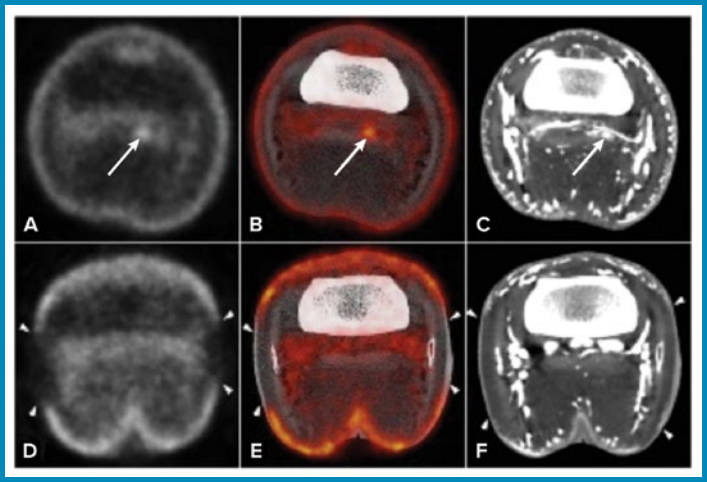


Figure 2

Transverse ^{18}F-FDG PET images (A and D), fused PET/CT images (B and E), and contrast-enhanced CT images (C and F) at the distal aspect of the middle phalanx on two different horses. The top row is a 15-year-old Quarter Horse mare with known chronic degenerative changes of the left front navicular bone (horse 1) and the bottom row is a 14-year-old Quarter Horse mare with chronic laminitis (horse 3). In horse 1, a marked focal area of ^{18}F-FDG uptake is present at palmar medial aspect of the middle phalanx. The fused PET/CT images confirm the location of this lesion within the dorsal aspect of the medial lobe of the deep digital flexor tendon. This area is also enhancing on the contrast-enhanced CT image but is harder to distinguish from adjacent blood vessels. In horse 3, lack of uptake of ^{18}F-FDG is identified both in the lateral and medial lamina (arrow heads) in comparison with the uniform uptake observed through the lamina in horse 1. This confirms a lack of contrast perfusion observed in these areas on the contrast-enhanced CT. This suggests that the lack of perfusion on the contrast-enhanced CT is not an artifact from arterial contrast administration but truly represents abnormal lamina.

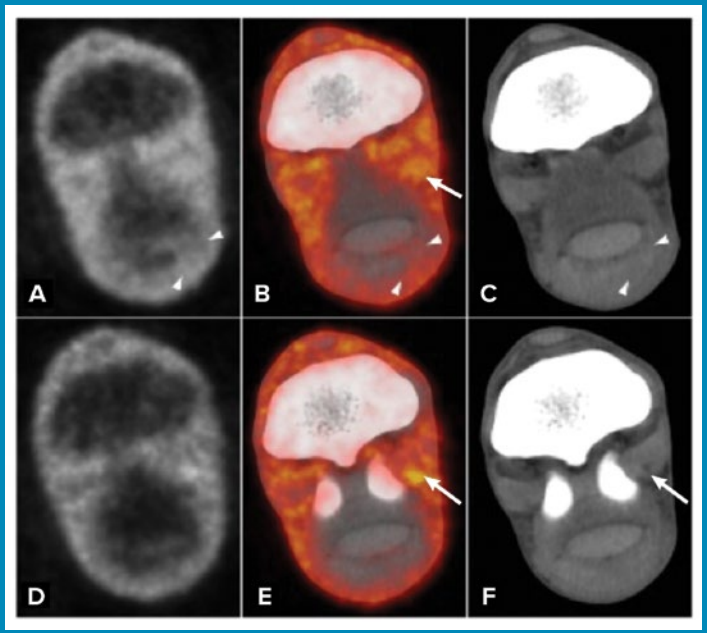


Figure 3

Transverse ^{18}F-FDG PET images (A and D), fused PET/CT images (B and E), and CT images (C and F) at the distal aspect of the metacarpus of a 20-year-old Thoroughbred mare (horse 2) with a history of chronic superficial digital flexor tendinopathy (SDFT). The top row presents images proximal to the proximal sesamoid bones whereas the distal row images were obtained through the apex of the proximal sesamoid bones. There is asymmetric uptake of ^{18}F-FDG in the suspensory branches with higher uptake in the lateral branch (arrows). This presents as a relatively diffuse uptake through the branch in the more proximal location (top row) and a more focal uptake at the level of the insertion (bottom row). The more focal uptake distally matches a hypointense area on the CT. Note also that the SDFT is enlarged on the CT images and mild increased uptake of ^{18}F-FDG is visible (arrow heads), consistent with a chronic lesion compatible with the history.

CENTER FOR EQUINE HEALTH Researchers

Monica Aleman, MVZ, Ph.D., DACVIM

Dr. Monica Aleman obtained her veterinary degree at the University UNAM-Mexico. She completed residencies in large animal internal medicine (equine emphasis) and neurology and neurosurgery at UC Davis; and achieved board certification for both specialties by the American College of Veterinary Internal Medicine. She completed a Ph.D. in comparative pathology of neuromuscular diseases at UC Davis. Her research and clinical interest has focused in neurology, neuromuscular and muscle disorders in all species with an equine emphasis. Currently, she is a faculty member in the equine internal medicine and neurology services, and Co-Director of the Neuromuscular Disease Laboratory at UC Davis. Dr. Aleman is one of the founding members of the Equine and Comparative Neurology Research Group, and is affiliated with the Clinical Neurophysiology Laboratory at UC Davis. Dr. Aleman is the author of over 90 peer reviewed medical publications, over 100 proceedings and abstracts, and over 25 book chapters and is a frequent speaker at national and international meetings. Currently, she works in the investigation of neurologic and neuromuscular disorders in multiple species, including humans.

Danika Bannasch, DVM, Ph.D.

Dr. Danika Bannasch earned her veterinary degree from the UC Davis School of Veterinary Medicine and her PhD degree in mouse molecular genetics at Princeton University. She is currently a professor in the Department of Population Health and Reproduction in the UC Davis School of Veterinary Medicine and is the first faculty member to hold the prestigious Maxine Adler Endowed Chair in Genetics. An accomplished veterinary geneticist, Dr. Bannasch focuses her research on the identification of the molecular causes of inherited diseases in dogs and horses. Her laboratory has identified the DNA changes responsible for Lethal White Foal Syndrome, Hereditary Equine Regional Dermal Asthenia, Hyperuricosuria, Alaskan Husky Encephalopathy, Cleft palate, Cleft lip and palate, Spinal Dysraphism, Glioma susceptibility, Chondrodystrophy and Saluki Spongiosis. Important research findings have also led to animal models used for similar human diseases. By studying naturally occurring diseases in animals, the Bannasch Laboratory is discovering a triad of significant advances: the development of diagnostic tests to aid animal breeders; the identification of novel genes and pathways as candidates for human disease; and an understanding of basic molecular mechanisms of disease.

Rebecca Bellone, Ph.D.

Dr. Bellone earned her Ph.D. in Equine Genetics from the University of Kentucky in 2001. Subsequently she has led an equine genetics research program involving both graduate and undergraduate students investigating the genetics of pigmentation and ocular disorders and the connection between the two. Her research team has collaboratively discovered causative mutations for both congenital stationary night blindness and ocular squamous cell carcinoma in horses. She is currently an Associate Adjunct Professor in the Department of Population Health and Reproduction and is the Director of the Veterinary Genetics Laboratory, a unit of the UC Davis School of Veterinary Medicine with an international reputation as experts in veterinary genetic testing.

Dori Borjesson, DVM, MPVM, Ph.D.

Dr. Dori Borjesson earned her DVM and MPVM degree from the UC Davis School of Veterinary Medicine in 1995 and completed a residency at UC Davis in Clinical Pathology in 1999 followed by a Ph.D. in Comparative Pathology at the UC Davis Center for Comparative Medicine in 2002. She joined the faculty as an Assistant Professor at the University of Minnesota for four years before returning to UC Davis as an Associate Professor in 2006. She currently serves as a Professor in the

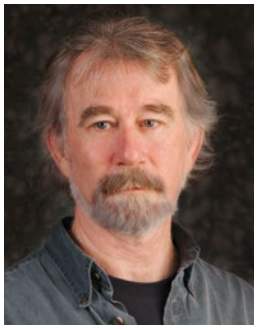
Department of Pathology, Microbiology and Immunology. She is the director of the Veterinary Institute of Regenerative Cures and her research focuses on mesenchymal stem cells and immunomodulation. Her team works to define and develop naturally-occurring animal models of disease to test cell therapies to improve animal health and inform human medical practice.

Robert Brosnan, DVM, Ph.D., DACVA

Dr. Robert Brosnan earned his veterinary degree from the UC Davis School of Veterinary Medicine in 1999, and a Ph.D. in Physiology from UC Davis in 2002. He is a Diplomate of the American College of Veterinary Anesthesia and Analgesia. Dr. Brosnan has developed technology that has identified agents in several novel classes that could lead to better, safer and more cost-effective general anesthetics for use in operating rooms and surgical centers. His research focuses on cardiovascular and respiratory effects of anesthetics and on the mechanisms of anesthetic action. Dr. Brosnan is currently a professor in the Department of Surgical and Radiological Sciences.

Derek Cissell, VMD, Ph.D., DACVR

Dr. Derek Cissell earned his B.S. in Animal Science from the University of Connecticut where he played intercollegiate polo and developed an interest in equine musculoskeletal injuries. He received his veterinary degree from the University of Pennsylvania in 2005. Following veterinary school, he worked for two years in a private, mixed-animal practice in northern Utah before returning to academia. He completed a residency at the UC Davis School of Veterinary Medicine in 2011, as well as earning his Ph.D. in biomedical engineering from UC Davis in 2015. Dr. Cissell joined the faculty in 2016 as an assistant professor in diagnostic imaging. Dr. Cissell's clinical and research interests include large animal diagnostic imaging and early diagnosis of cartilage injuries.



Alan Conley, BVSc, MS, Ph.D., FRCVS

Dr. Alan Conley is a professor, Director of the Clinical Endocrinology Laboratory and current Chair of the Department of Population Health & Reproduction in the UC Davis School of Veterinary Medicine. He also holds the John P. Hughes Endowed Chair in Equine Reproduction. His veterinary degree was awarded by the University of Melbourne and he saw dairy practice and mixed practice in Australia and in Scotland before completing a residency in theriogenology, and then Masters and PhD degrees, at Iowa State University. He was an NIH Fellow at UT Southwestern Medical Center in Dallas, a Research Scientist with the USDA in Nebraska and on faculty at North Dakota State University before coming to UC Davis. He earned a Diploma of Fellowship from the Royal College of Veterinary Surgeons (FRCVS) in recognition of his contributions to comparative reproductive physiology, publishing almost 170 research papers to date. Much of this work has related to sex steroid synthesis but in recent years with a particular focus on equine reproductive endocrinology and the developing new diagnostic endocrine assays. He teaches reproduction in the veterinary curriculum and courses in reproduction to graduate students.

Julie Dechant, DVM, MS, DACVS, DAVECC

Dr. Julie Dechant received her DVM from the University of Saskatchewan in 1996 and completed an MS and surgical residency in 2000 at Colorado State University. After faculty appointments at Saskatchewan and Oklahoma State University, Dr. Dechant joined the UC Davis School of Veterinary Medicine faculty as an associate professor of clinical equine surgical emergency and critical care in 2004. She is a Diplomate of the American College of Veterinary Surgeons and the American College of Veterinary Emergency and Critical Care. In 2014 was elected a Fellow in the Teaching Academy of the Consortium of West Region Colleges of Veterinary Medicine.

Ghislaine Dujovne, DVM, MS, DACT

Dr. Ghislaine Dujovne obtained her DVM from the University of Chile, College of Veterinary Sciences in 2004 and remained there to obtain her Diploma in Animal Reproduction with an equine emphasis. She worked in private general practice and as a reproductive consultant to numerous Thoroughbred breeding farms before she began a residency in theriogenology (equine reproduction) at Auburn University in 2008. Dr. Dujovne completed her residency and Master of Science degree (studying the use of etonogestrel implantation for estrogen suppression in mares) in 2011, and remained at Auburn gaining experience as a clinical reproduction instructor. She is a diplomate of the American College of Theriogenologists. She joined the UC Davis School of Veterinary Medicine as an associate staff veterinarian and clinical professor in equine reproduction in 2012.

Carrie Finno, DVM, Ph.D., DACVIM

Dr. Carrie Finno is an associate professor and equine internist who received her DVM from the University of Minnesota (UMN) in 2004. She completed an internship in large animal medicine and surgery at UMN in 2005 and then went on to complete a 3-year residency in large animal internal medicine at UC Davis, culminating in board-certification in the American College of Veterinary Internal Medicine. Dr. Finno elected to pursue a career in equine genetic research, with a strong focus on neuromuscular disease, and obtained her Ph.D. in 2012 from UC Davis. Dr. Finno's research is focused on equine genetic diseases, including equine neuroaxonal dystrophy/equine degenerative myeloencephalopathy (NAD/EDM), equine shivers, myofibrillar myopathy and immune-mediated myositis. In conjunction with the equine studies, she is researching the interaction of vitamin E and neural development, using a well-established mouse model. Dr. Finno was appointed as the director of the UC Davis Center for Equine Health in 2017 and is an associate professor in the Department of Population Health and Reproduction.

Larry Galuppo, DVM, DACVS

Dr. Larry Galuppo is a professor and Chief of Equine Surgery at UC Davis. He graduated from the UC Davis School of Veterinary Medicine in 1990 and completed an internship at Rood and Riddle Equine Hospital in 1991. He completed an equine surgery residency at UC Davis from 1991 to 1994, and he has been on the faculty at UC Davis since 1996. His area of clinical expertise is in equine orthopedic surgery, including tendon, ligament and joint disorders, with a special interest in traumatology and fracture repair. His research emphasis is on the biomechanics of fracture generation, implant design and fracture repair, with a recent focus in management of musculoskeletal injuries using regenerative medicine therapies in sport horses.

Meera Heller, DVM, Ph.D., DACVIM

Dr. Meera Heller recently joined the Livestock Medicine and Surgery Service as an Assistant Professor of Clinical Livestock Medicine. Dr. Heller received her DVM degree (2001) and her PhD in Comparative Pathology (2009) from UC Davis. Following veterinary school, she completed an internship in large animal medicine and surgery (2002) at the Atlantic Veterinary College in Canada. She then returned to UC Davis to complete a residency in large animal internal medicine in 2005. Dr. Heller was an Assistant professor of Food Animal Medicine and Surgery at the University of Missouri before moving back to Davis this summer.

Scott Katzman, DVM, DACVS

Dr. Scott Katzman received his B.S. in Veterinary Science and DVM from the University of Minnesota College of Veterinary Medicine. Following four years in private practice, Dr. Katzman returned to academia to complete a three-year residency in Equine Surgery at the UC Davis School of Veterinary Medicine and is a board certified Diplomate of the American College of Veterinary Surgeons. Following completion of his surgical training, Dr. Katzman spent the following two years as the staff surgeon at an equine referral clinic in Minnesota, as well as working at a variety of equine referral practices across the country before joining the Equine Surgery and Lameness Service at UC Davis. Dr. Katzman has a special interest in musculoskeletal injury in racehorses and upper respiratory surgery.

Isabelle Kilcoyne, MVB, DACVS

Dr. Isabelle Kilcoyne earned her veterinary degree from the University of Dublin (Ireland) in 2008, after which she spent a year as an equine surgical intern at their University Veterinary Hospital. She then joined the UC Davis School of Veterinary Medicine, first as a team member with the Equine Field Service for two years, and then completed a three-year residency in equine surgery. Dr. Kilcoyne joined the Equine Surgical Emergency and Critical Care Service as an assistant clinical professor in 2016. Dr. Kilcoyne is board certified Diplomate in the American College of Veterinary Surgeons. Her main clinical and research interests are in emergency surgery and medicine, particularly gastrointestinal surgery.

Heather Knych, DVM, Ph.D., DACVCP

Dr. Heather Knych is an Associate Professor of Clinical Veterinary Pharmacology. She attended the University of California, San Diego for her undergraduate work and the UC Davis School of Veterinary Medicine for her DVM and Ph.D. (Pharmacology). She is a diplomate of the American College of Veterinary Clinical Veterinary. Dr. Knych's research focuses on equine drug metabolism and pharmacokinetic/pharmacodynamic (PK/PD) relationships of drugs in performance horses. Additionally, Dr. Knych provides guidance to researchers at UC Davis and other universities as well as to drug companies on PK/PD study design. She assists with drug concentration determination and pharmacokinetic analysis in various biological matrices.

Mary Lassaline, DVM, Ph.D., MA, DACVO

Mary Lassaline received her veterinary training at Michigan State University. She completed an internship in equine medicine and surgery at Rood and Riddle Equine Hospital in Lexington, Kentucky and a residency in comparative veterinary ophthalmology at the University of Florida. She worked in private ophthalmology practice for two years in Fairfield County, Connecticut before joining the faculty at the University of Pennsylvania's New Bolton Center, where she started a full time equine ophthalmology service. She joined the ophthalmology team at UC Davis to support the expansion of the large animal ophthalmology service. Dr. Lassaline is a Diplomate of the American College of Veterinary Ophthalmologists. She publishes regularly in scientific veterinary journals, is on the editorial board for the journals Veterinary Ophthalmology and Equine Veterinary Journal, is Chair of the American Board of Veterinary Ophthalmologists Credentials Committee, and is engaged in clinical research on equine corneal disease.

Sarah le Jeune, DVM, DACVS, DECVS, DACVSMR, CVA

Dr. Sarah le Jeune is a board-certified equine surgeon and has been a member of the UC Davis Equine Surgery faculty since 2003. Dr. le Jeune is also a member of the American College of Veterinary Sports Medicine and Rehabilitation and focuses on the diagnosis and treatment of lameness and various performance-related musculoskeletal injuries by and integrative approach including acupuncture and chiropractic. She is a certified veterinary acupuncturist with extensive acupuncture training from the Colorado State University and the Chi Institute in Florida. She also obtained certification in veterinary chiropractic by the International Veterinary Chiropractic Association.

John Madigan, DVM, MS, DACVIM

Dr. John Madigan is a distinguished professor of medicine and epidemiology at the UC Davis School of Veterinary Medicine and a diplomate of the American College of Veterinary Internal Medicine and the American College of Animal Welfare. He is a clinician in equine medicine at the Veterinary Medical Teaching Hospital where he started the UC Davis Veterinary Medical Teaching Hospital Equine Neonatal Critical Care Unit in 1987. He leads the Comparative Neurology Research Group at UC Davis investigating neurological conditions of horses and humans.

He has published over 175 peer-reviewed manuscripts. He is a recipient of a Bill and Melinda Gates Foundation grant with Stanford Medical School and UC Davis medical school investigating transition of consciousness at birth in infants based on recent discoveries in neonatal foals.

K. Gary Magdesian, DVM, DACVIM, DACVECC, DACVCP

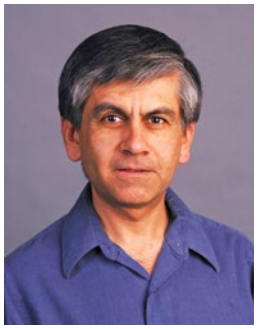
Dr. Gary Magdesian received his DVM from the UC Davis School of Veterinary Medicine and completed an internship in large animal medicine and surgery at the College of Veterinary Medicine at Texas A&M University. This was followed by residencies in equine internal medicine, equine emergency medicine/critical care and clinical pharmacology at the School Veterinary Medicine, UC Davis. Dr. Magdesian is board certified in internal medicine, emergency/critical care and Pharmacology (Diplomate ACVIM, ACVECC, ACVCP). Currently, Dr. Magdesian is a professor in the Department of Medicine and Epidemiology and holds the Roberta and Carla Henry Endowed Chair in Emergency Medicine and Critical Care at the UC Davis School of Veterinary Medicine while also serving as the Chief of the Large Animal Medicine Services at the William R. Pritchard Veterinary Medical Teaching Hospital.

Stuart Meyers, DVM, Ph.D., DACT

Dr. Stuart Meyers, a professor in the Department of Anatomy, Physiology, and Cell Biology, earned his veterinary degree from the University of Michigan in 1985 and his Ph.D. in comparative pathology from UC Davis in 1995. He is a Diplomate of the American College of Theriogenologists. Dr. Meyers' research focuses on membrane and cytosolic events associated with sperm cell function and to develop methods by which sperm preservation and fertility can be advanced. The laboratory is examining the role of membrane lipid domains and their associated proteins relative to sperm capacitation, osmotic and oxidative stress, and cryopreservation. Studies are aimed at optimization of male genome preservation and understanding of mechanisms of male subfertility.

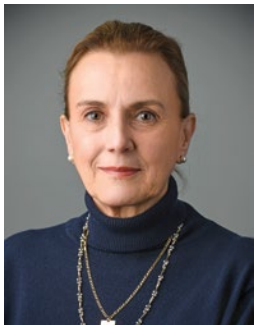
Mike Mielentowski, DVM, Ph.D.

Dr. Mike Mielentowski earned is DVM degree from Michigan State University in 2004, followed by his Ph.D. at the University of Kentucky in 2008. He continued with post-doctoral training at the University of South Florida from 2008 through 2014, with a focus on molecular pharmacology and physiology, orthopedics and sports medicine. He joined the faculty of the UC Davis College of Agricultural and Environmental Sciences in 2014.



Jorge Nieto, MVZ, Ph.D., DACVS, DAVSMR

Dr. Jorge Nieto earned his veterinary degree from National University of Mexico, Mexico City, Mexico and his Ph.D in comparative pathology from the University of California, Davis in 2004. He joined the faculty of the School of Veterinary Medicine as an assistant professor in Equine Surgical Emergency and Critical Care in 2007. He is a diplomate of the American College of Veterinary Surgeons and a diplomate of the American College of Veterinary Sports Medicine and Rehabilitation. Dr. Nieto contributed significantly to the diagnosis of colic, specifically intestinal ischemia, and treatment of gastric ulcers in horses.



Cecilia Penedo, Ph.D.

Dr. Cecilia Penedo received her Ph.D. in Genetics from the University of California, Davis in 1999. She began working at the Veterinary Genetics Laboratory during her graduate career and stayed on as an expert in genetics and parentage analysis of domestic animals. She played a key role in the transition from blood typing to DNA testing for several species tested by the laboratory. As Associate Director, she currently heads the Service section of the Veterinary Genetics Laboratory. She has extensive expertise in parentage and diagnostic DNA testing and is an active participant in international efforts for standardization of genotyping tests for livestock and companion animal species. In 2016, she was recognized for her contributions to this area and was appointed a Fellow of the International Society of Animal Genetics. Her research includes investigations of the molecular basis of coat color and diseases, and prenatal genetic testing in horses, genetic diversity and population structure of livestock, laboratory and wildlife species.

Kathryn Phillips, DVM, DACVR

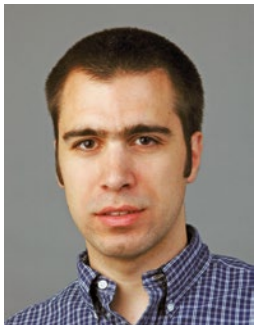
Dr. Kathryn Phillips earned her veterinary degree from Michigan State University College of Veterinary Medicine in 2008. The following year she completed a rotating internship at Southwest Equine Medical and Surgical Center in Scottsdale, Arizona. This was followed by a year at Ross University School of Veterinary Medicine in St. Kitts, West Indies, where Dr. Phillips was a clinical instructor and an intern in diagnostic imaging. Dr. Phillips completed her residency in diagnostic imaging at North Carolina State University in 2013. She then stayed at North Carolina State University an additional year as an assistant professor before joining UC Davis in 2015.

Nicola Pusterla, DVM, Ph.D., DACVIM

Dr. Nicola Pusterla graduated from the School of Veterinary Medicine at the University of Zurich, Switzerland in 1991. Dr. Pusterla worked in the private and academic sector with a focus in large animal internal medicine. Dr. Pusterla earned his Ph.D. from the University of Zurich with an emphasis on vector-borne diseases. He joined UC Davis in 1998 where he currently has an appointment as a Professor in Equine Internal Medicine in the Department of Medicine and Epidemiology. Dr. Pusterla is a Diplomate of the American College of Veterinary Internal Medicine with an equine emphasis, and he has ongoing interest in all aspects of equine internal medicine and dentistry. Dr. Pusterla's research focuses on selected aspects of equine infectious diseases with an emphasis on epidemiology, clinical disease understanding, diagnostics, prevention, and treatment.

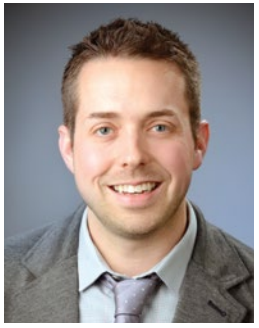
Sharon Spier, DVM, Ph.D., DACVIM

Dr. Susan Spier, a professor emeritus in the UC Davis School of Veterinary Medicine, earned her veterinary degree from Texas A&M University in 1983 and her Ph.D. in Comparative Pathology from the University of California, Davis in 1989. She is Diplomate of the American College of Veterinary Internal Medicine. Dr. Spier's research focus is on Corynebacterium pseudotuberculosis infections in horses and she pioneered the understanding of hyperkalemic periodic paralysis in horses.



Mathieu Spriet, DVM, M.S., DACVR, DECVDI

Mathieu Spriet graduated from the National Veterinary School of Lyon (France) in 2002. He then completed an equine internship at the University of Montreal (Canada). He received his Master Degree in clinical sciences, also at the University of Montreal in 2004. He completed his residency in diagnostic imaging at the University of Pennsylvania from 2004 to 2007. He is currently an Associate Professor of Clinical Diagnostic Imaging at the UC Davis School of Veterinary Medicine. He is a diplomate of both the American College of Veterinary Radiology and the European College of Veterinary Diagnostic Imaging. His clinical work includes all imaging modalities in both small and large animals. His research interest is on musculoskeletal imaging with an emphasis on the use of magnetic resonance imaging, computed tomography and nuclear scintigraphy in horses. He has conducted several projects on in-vivo stem cell tracking in horses, dogs and cats. He is a member of the UC Davis Veterinary Institute for Regenerative Cures.



Joshua Stern, DVM, Ph.D., DACVIM

Dr. Joshua Stern is an associate professor and residency program director for cardiology at the UC Davis School of Veterinary Medicine. He operates one of only a few translational cardiac genetic laboratories in the world. Together with a team of graduate students he studies the intersection of genetics and cardiac pharmacology and focuses on mutation discovery and pathogenesis for inherited heart disease. Dr. Stern serves as an associate editor for the Journal of Veterinary Cardiology and is the chair of the board examination committee for the American College of Veterinary Internal Medicine subspecialty of Cardiology. Through his work with the cardiology service at UC Davis, Dr. Stern leads cutting edge interventional procedures, identifies novel diagnostic approaches and carries out clinical studies for novel therapeutics.

Susan Stover, DVM, Ph.D.

Dr. Stover is a professor and Director of the J.D. Wheat Veterinary Orthopedic Research Laboratory at the UC Davis School of Veterinary Medicine. She received her veterinary degree from Washington State University, and subsequently completed an equine surgery internship and residency at UC Davis. She was in equine practice in Washington State before returning to UC Davis to teach clinical equine lameness and surgery to veterinary students and residents. She became board certified by the American College of Veterinary Surgeons while pursuing a Ph.D. program focused on equine orthopedic research (dorsal metacarpal disease ('bucked shins') in Thoroughbred racehorses). She now devotes her time to equine orthopedic research and has authored over 200 research publications. She has mentored numerous veterinary students, graduate students and residents in research. She teaches musculoskeletal anatomy, biomechanics, and pathology to veterinary students. She was honored with the American Veterinary Medical Association Lifetime Excellence in Research Award in 2016.

Fern Tablin, VMD, Ph.D.

Dr. Fern Tablin earned her VMD in 1980 and her Ph.D. in 1984 from the University of Pennsylvania. Dr. Tablin joined the UC Davis School of Veterinary Medicine faculty in 1985, with a research focus on platelet physiology and the role of platelets in health and disease, with a concentration on the contribution of platelets to the systemic, cardiac and pulmonary proinflammatory responses to air pollution. Serving as co-director for the Center for Biostabilization, Dr. Tablin developed novel methods for storage of blood cells and nucleated cells in the dry state. She was inducted into the American Association for the Advancement of Science in 2002 and awarded the Pfizer Distinguished Teacher Award in 2012.

Alain Théon, DVM, M.S., Ph.D., DACVR

Dr. Alain Théon received his DVM from Ecole Nationale Vétérinaire d'Alfort, (Maisons-Alfort France). Upon graduation from veterinary school Dr. Théon completed a 3-year research doctorate program in Radiation Biology at University Paris-Est (Creteil, France) concurrently with a 2-year internship in Radiation Oncology at Tenon Hospital (University Medical Center in Paris, France). During this time he decided to pursue a career in veterinary radiation oncology because it fulfilled his interest in cancer research, technology and patient care. As a result, he decided to move to the United States to pursue a training program in veterinary radiation oncology since none were available in France. He completed a 2-year limited-status residency in Therapeutic Radiology at the UC Davis School of Veterinary Medicine.

He completed a M.S. degree in Comparative Pathology at UC Davis funded by the Center for Companion Animal Health. He joined the UC Davis School of Veterinary Medicine faculty in 1990. Since then he has dedicated his career to teaching and research that benefits dogs, cats and horses with cancer.

Joie Watson, DVM, Ph.D., DACVIM

Dr. Joie Watson received her veterinary degree in 1986 and her Ph.D. in 1994 from the UC Davis School of Veterinary Medicine and joined the faculty in 1996 as a professor of equine medicine. She is a Diplomate of the American College of Veterinary Internal Medicine. Her research focus is in immunology and infectious diseases in horses. In 2014, she was honored with the UC Davis School of Veterinary Medicine's Faculty Distinguished Teaching Award.

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The Silver Stirrup Society is a unique equine organization. It provides the Center for Equine Health with financial support for programs and activities that cannot be funded by state resources. The Silver Stirrup Society also provides a forum for sharing new advances in equine research and veterinary care. Membership is open to associations, clubs and individuals who contribute $1,000 or more annually to the Center for Equine Health. Lifetime memberships are offered to donors of larger gifts and bequests of $25,000 or more.

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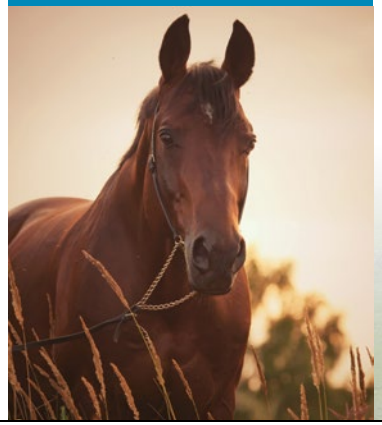

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NEW TECHNOLOGY SOLVES Mystery Lameness

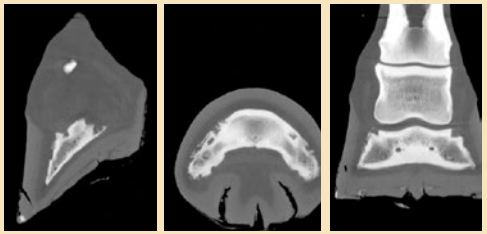
Five O'Clock Somewhere (aka "Chunky"), a 16-year-old Thoroughbred/Quarter horse gelding, became acutely lame in his right front limb following a three-day event. An MRI performed by his local veterinarian revealed injuries to the collateral ligaments of both front limbs and osteoarthritis of the right front distal interphalangeal joint (coffin joint in hoof). A recheck MRI demonstrated persistent collateral ligament injuries, and Chunky remained lame despite a year-long layup.

To seek an expert opinion, his veterinarian referred Chunky to the UC Davis veterinary hospital for further diagnostic tests. In September 2017, the right front lameness was localized to the foot. Chunky was imaged at UC Davis utilizing positron emission tomography (PET scan), which can detect active change in both the tissue and bone.

The PET images demonstrated increased active bone growth at the attachment of the right lateral collateral ligament on the distal phalanx, associated with marked active bone growth of the lateral palmar process of the distal phalanx. Abnormalities of the attachment of the collateral ligaments were seen medially and on the left foot, but there was no abnormal tracer uptake in these areas. Mild changes were seen in the navicular bone on both sides. There was abnormal uptake to the lamina of both front feet. The soft tissue tracer did not show any ligament or tendon abnormalities.

From these findings, it was concluded that the main reason for Chunky's lameness was the lesion at the distal attachment of the right lateral collateral ligament and the increased stress on the lateral aspect of the distal phalanx. He was treated with specific shoeing recommendations to decrease the stress in these areas.

September 2017



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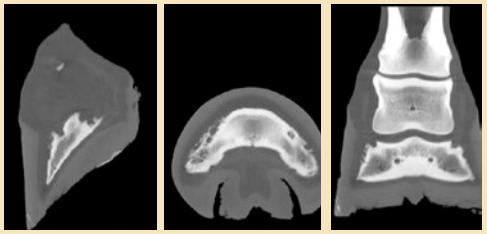

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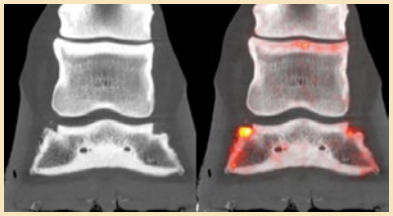

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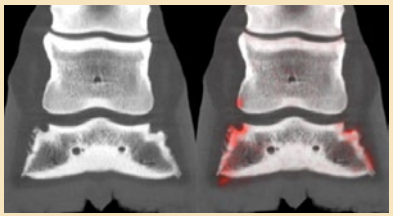

Following the shoeing therapy, Chunky's lameness improved. He returned to UC Davis for a recheck six months after the initial PET scan. His lameness in his right front hoof had resolved and a mild lameness persisted on the left front hoof. It was recommended that the PET scan be repeated.

This time, the PET images showed tracer uptake at the distal attachment of the lateral collateral ligament and at the lateral palmar process on the right front foot had markedly reduced. The laminar uptake in the right front foot had returned to normal. The tracer uptake at the attachment of the collateral ligaments of the left front foot had slightly increased. This confirmed that the shoeing treatment had helped resolved the insertional injury of the right lateral collateral ligament and the stress on the lateral palmar process. The residual lameness on the left was likely due to a flaring of the chronic collateral changes also present on the left foot.

PET technology had been instrumental at recognizing which of all the chronic changes seen on Chunky's initial MRI was the cause of the lameness. The recheck scan after improvement of the lameness confirmed healing of the injury on the right foot and the progression of changes on the left foot explained the current lameness presentation.

Chunky's owner, Megan Compton, is thrilled to have her partner back to good health, though it will be some time before they are able to show again.

"I had bad experiences as a young rider with a very naughty pony. Chunky took me under his wing to teach me and gave me the confidence to compete. I'm so happy to be able to ride him again," said Ms. Compton. "The doctors at UC Davis were amazing! They care as much as I do. They said that we are going to look for a deeper meaning to his lameness and find his problem."

The Center for Equine Health supported the development of PET technology at the William R. Pritchard Veterinary Medical Teaching Hospital.


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