

CEH HORSEREPORT

A publication of the Center for Equine Health, UC Davis School of Veterinary Medicine

Neuromuscular Disease in Horses What Every Horse Owner Should Know

Horse enthusiasts may be more inclined to read about vaccinations, emergency first aid, and colic than topics that appear to be more remote from everyday life such as genetics, or this issue's feature on neuromuscular disease. The truth is, these subject areas affect a good many horses and their owners, and having some knowledge about them may prove to be invaluable if your horse encounters problems in the future. As we would do for our children, we can be exceptional advocates by becoming informed on health issues and working as adjuncts to the physician or veterinarian to receive the best possible care.

It's Not Just "Tying-Up" Anymore

Horsemen and equine veterinarians have known and practiced the drill for years. The horse gets anxious, starts to become uncomfortable, then stiffens up and finally begins to sweat and show signs of obvious muscle pain. "She's tied-up," comes the call, which sets off a standard course of treatment and husbandry changes. There is usually little done in the way of diagnostics, other than possibly checking the level of muscle enzymes, and one tied-up horse is considered just like another. This standard menu may suffice when the event is a one-time or infrequent occurrence. But for

horses experiencing the problem more often—the one that ties up every time you push him a little too hard—our old methods have never been sufficient.

Today, however, things are changing. The research of Dr. Monica Aleman and others is beginning to show that within the diagnostic catch-all bag we refer to as "tying-up," there are a wide variety of conditions. Each of these has its own very subtle characteristics, and each often has a cause that is distinct and separate from the others. New and sophisticated diagnostic procedures and highly specialized muscle biopsy analyses are just beginning to surprise us with the findings of a myriad of previously unknown muscle abnormalities.

What is Neuromuscular Disease?

Horses have always played an extremely important role in human his-

tory. One of the reasons the horse has been so successful in its partnership with humans is its ability to move. Whether horses are used for work, performance at the racetrack, for endurance or pleasure

— Continued on page 3



INSIDE THIS ISSUE...

Neuromuscular Disease	1
Director's Message.....	2
Diagnostic Work-Up for	
Muscle Disorders	6
Donor Support	8
New Equine Athletic	
Performance Lab	10
A Prince of a Story	11
Upcoming Events	12

DIRECTOR'S MESSAGE



Dr. Gregory L. Ferraro

We have decided to focus this issue of our Horse Report largely on the activities of Dr. Monica Aleman, because in many ways she represents the future of veterinary academics and clinical medical training. A bright and dynamic young scientist, Dr. Aleman's unique combination of intellect, dedication and international experience will undoubtedly influence both the scope and context of equine clinical medicine in the decades ahead. Moreover, her curiosity and passion for her craft and the patients she serves will provide a model for her students to follow.

Dr. Aleman received her veterinary degree from the National Autonomous University of Mexico in 1991. She gained clinical experience working with the Mexican Army and the Mexican National Equestrian Team. She was recommended for an externship program at Louisiana State University and eventually found her way to the UC Davis School of Veterinary Medicine in 1992.

It wasn't long before faculty and staff at our Veterinary Medical Teaching Hospital began to take note of the obvious potential of their new recruit. Dr. Aleman soon became a well-liked and respected resident house officer in the Large Animal Clinic.

New Faculty Member Brings the Best of Two Worlds to Diagnostic Work

She excelled at her work and easily passed her examinations and qualified for board-certification in the field of equine internal medicine.

Senior clinicians, faculty members and veterinary school administrators knew there was yet more potential in Dr. Aleman and soon began discussing the possibilities of advanced degrees and faculty positions. Dr. Aleman had expressed a keen interest in the underexplored field of equine neuromuscular disease, and when offered the possibility

achieved her coveted PhD degree. Along the way, she discovered the genetic mutation and a diagnostic test for a poorly understood and potentially lethal disease known as equine malignant hyperthermia. She has recently been offered and accepted a full-time faculty position at the UC Davis School of Veterinary Medicine and now stands on the threshold of what undoubtedly will be an outstanding career.

The best part is that she is currently available to VMTH clients and

Dr. Aleman's new neuromuscular disease laboratory and the clinical diagnostic services that she can provide will, I predict, open up a whole new area of knowledge and understanding regarding muscle diseases and their related problems of poor performance.

of mentorship toward a PhD in that field, she readily accepted. The only problem was one facing many of our most talented new potential scientists: After 12 to 15 years of education and its attending financial burden, how could one afford to continue another 4 years of educational expense?

The solution to that problem came in the form of a Sacramento-based benevolent organization known as the Kelly Foundation and a program they designed specifically for the advanced education of individuals demonstrating the potential to be both academic scientists and hands-on clinicians. Their Edwin J. Gregson Fellowship in Equine Studies, named after the famous renaissance trainer of racehorses, provided the resources necessary to advance Dr. Aleman to the next level of her education.

With the support of that fellowship, Dr. Aleman has completed her studies, written her thesis and

their horses and is beginning the development of a new medical service for the horses she loves so much. Dr. Aleman's new neuromuscular disease laboratory and the clinical diagnostic services that she can provide will, I predict, open up a whole new area of knowledge and understanding regarding muscle diseases and their related problems of poor performance.

What you will read about in the following pages is who Dr. Monica Aleman is, why her field of expertise is so important, and how she can help many horses with problems that in the past were either misdiagnosed or poorly understood. Please, read with care the story of my colleague, a scientist, a teacher and a caregiver for many, many horses to come.

Neuromuscular Disease — Continued from page 1

riding, or simply running free in the wild, certainly movement defines a horse's existence. Effective locomotion depends on the coordination of various body systems, but ultimately movement depends on nerves and skeletal muscles. It has been estimated that muscle constitutes up to 53% of the adult horse's body weight, and that 75 to 90% of such muscle mass is skeletal muscle involved with locomotion.

The skeletal muscle is composed of muscle cells or myofibers. Each myofiber is stimulated by a motor nerve that derives from the spinal cord. The junction between a nerve ending and a myofiber is called the neuromuscular junction (see photo on page 5). Abnormalities or diseases could occur at the nerve (neuropathy), neuromuscular junction (neuromuscular disorder), or muscle (myopathy) level. Muscle atrophy could occur secondary to a neurological problem.

Clinical signs associated with muscle problems (or myopathies) vary, but the most common signs include poor performance, exercise intolerance, "tying up", stiffness, weakness, lameness, excessive sweating, and increased respiratory and heart rates associated with exercise. There are also myopathies that are not related to exercise but are exacerbated by it.

Some myopathies studied in the Neuromuscular Disease Laboratory at UC Davis involve both the nervous system and muscles, while others involve primarily the musculature or nervous system. Recent advances in the ability to study muscle biopsies through improved staining techniques have significantly improved diagnostic capabilities and opened up a whole new area of knowledge and understanding regarding muscle diseases and their related problems of poor performance.

In the past, muscle disorders were usually indicated by an elevated creatine kinase (CK) in the blood. If

a horse had a normal CK value, it was an indication that the problem manifesting itself was not a muscle problem. However, because researchers now have the capability to examine tissues at the cellular level and to study changes that occur as a result of disease or other conditions, we have learned that a horse can have a normal CK and still have a muscle problem. The ability to study muscle biopsies at the cellular level has made it possible to determine that even vaccinations or common ailments such as the flu or herpes virus can affect muscle tissue. Moreover, researchers have now established a link between certain types of cancer and muscle disorders.

At the UC Davis Veterinary Medical Teaching Hospital, a significant number of horses have been seen over the last 15 years with some type of neuromuscular problem. The most common disorders involving muscle have included recurrent exertional rhabdomyolysis (RER), nutritional myopathy (vitamin E and selenium deficiency), polysaccharide storage myopathy (PSSM), and hyperkalemic periodic paralysis (HYPP) (see below for descriptions). Other, less common disorders also have been seen, including some that are the result of anesthesia or trauma.

The number of muscular/neurological cases seen at UC Davis has increased in recent years and now numbers about 250 cases a year. By far, the two most commonly diagnosed diseases include cervical vertebral malformation ("wobbler") and equine protozoal myeloencephalitis (EPM). Numerous other neurological conditions have been seen, including epilepsy and neuropathies (physical or functional disturbances).

Equine neuromuscular disorders are understudied, poorly understood, and in many cases not yet identified. The limited information available on normal parameters for nerve and muscle systems in horses contributes to the gaps in our knowledge. Because therapeutic options for each disorder cannot be considered until

an accurate definition and diagnosis can be made, it is critical that research and development continue in this area.

Neuromuscular Disease Laboratory

Since its establishment in the mid-1970s, the Neuromuscular Disease Laboratory at UC Davis has made tremendous advances in its ability to study, define and diagnose neuromuscular diseases. It routinely receives numerous muscle, nerve and serum samples for analysis from patients all over the world. As such, the laboratory has recently diverged to allow adequate attention and focus to be placed individually on muscular disorders and neurological disorders. Dr. Monica Aleman was recently appointed to direct the research efforts involving disorders of the muscles. Listed below are some of the conditions/diseases she and her research staff are studying.

Specific Muscle Disorders

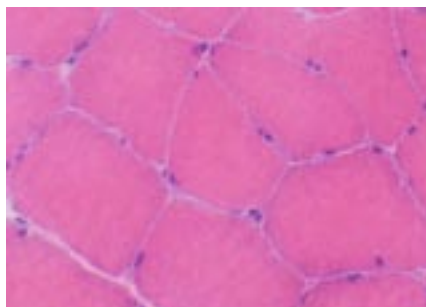
Equine Motor Neuron Disease (EMND). Equine motor neuron disease is an acquired neurodegenerative disorder of adult horses that affects the lower motor neurons located in the ventral spinal cord and brainstem. The disease has been reported in several breeds but mainly in Quarter Horses. EMND is characterized by generalized neuromuscular weakness and neurogenic muscle atrophy. The disease resembles amyotrophic lateral sclerosis (ALS) in humans. The exact cause of the disease is unknown but is thought to result from oxidative injury stemming from chronic lack of antioxidants (vitamin E deficiency). A common risk factor in horses with EMND is the lack of green forage.

"Tying up". "Tying up" is a commonly used term for horses that develop a stiff short-stride gait with firm painful muscles associated with exercise. Another term used is *rhab-*

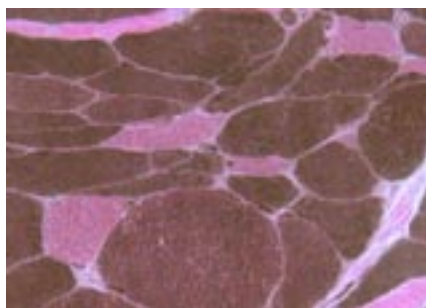
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Neuromuscular Disease — Continued from page 3

omyolysis. These terms are used regardless of the actual cause of the disorder, but multiple causes could be responsible for the observed clinical signs. *Rhabdomyolysis* signifies destruction of the muscle and includes specific types of conditions, including recurrent exertional rhabdomyolysis (RER), polysaccharide storage myopathy (PSSM), untrained/unfit horses performing exercise, and excessive exercise.



Muscle biopsy from a normal horse.



Muscle biopsy from a horse with equine motor neuron disease, showing neurogenic muscle atrophy (shrinkage of muscle tissue).

Recurrent Exertional Rhabdomyolysis (RER). This disease is inherited as an autosomal dominant trait in Thoroughbred horses. An estimated 5% of the racing Thoroughbred population may be affected. RER may present with muscle cramps especially of the hindquarters, profuse sweating, pain, reluctance to move, anxiety and recumbency. The onset of the disease is generally observed at the initiation of training and is more common in nervous fillies. Prolonged periods of rest followed by exercise are a risk factor.

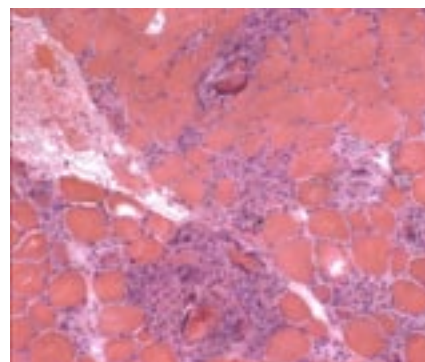
Polysaccharide Storage Myopathy (PSSM). PSSM is a muscle disease described mainly in Quarter Horses, American Paint horses and Appaloosas. The disease has been commonly observed in Draft horses as well as Draft crossbreeds, and other breeds such as Warmbloods and Andalusians have been reported. The disease is hereditary in Quarter Horses, but a specific gene mutation has not been identified yet. PSSM is characterized by repeated episodes of exertional rhabdomyolysis, stiff gait, stretching out in stance, pain, sweating, reluctance to move, and even recumbency. Draft horses may exhibit exertional rhabdomyolysis with muscle cramps or poor performance with a shivers-like gait, muscle wasting, weakness and recumbency.

Hyperkalemic Periodic Paralysis (HYPP). HYPP is an autosomal dominant inherited disease in Quarter Horses, American Paint horses, Appaloosas and related breeds. The disease is caused by a genetic mutation. It is characterized by episodes of muscle fasciculations (involuntary contractions), weakness, difficulty in swallowing, laryngeal paralysis, recumbency and even death. Between episodes, horses appear normal.

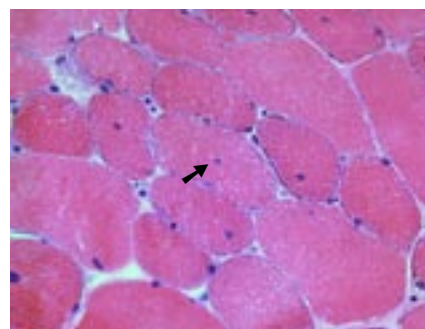
New Insight Into a Poorly Understood Muscular Disease in Horses

Equine Malignant Hyperthermia (EMH) is a life-threatening pharmacogenetic (involving a defective gene and the abnormal body's response to drugs) disorder of skeletal muscle brought on by exposure to volatile anesthetics such as halothane, depolarizing muscle relaxants (succinylcholine), and stress. The disease has been genetically confirmed in humans, pigs and dogs but not in horses.

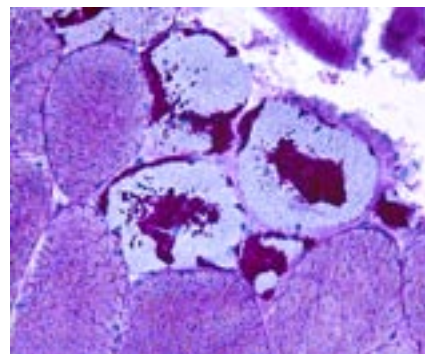
For her PhD research, Dr. Aleman conducted a study to investigate whether mutations in a particular gene (ryanodine receptor 1, or RyR1) were associated with MH in two clinically affected horses. These horses



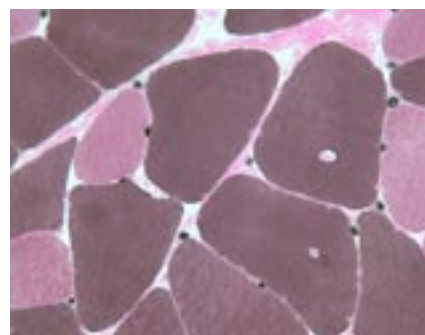
Muscle biopsy from a horse with exertional rhabdomyolysis during an acute episode.



Muscle biopsy from a horse with recurrent exertional rhabdomyolysis (RER). Note multiple central nuclei.

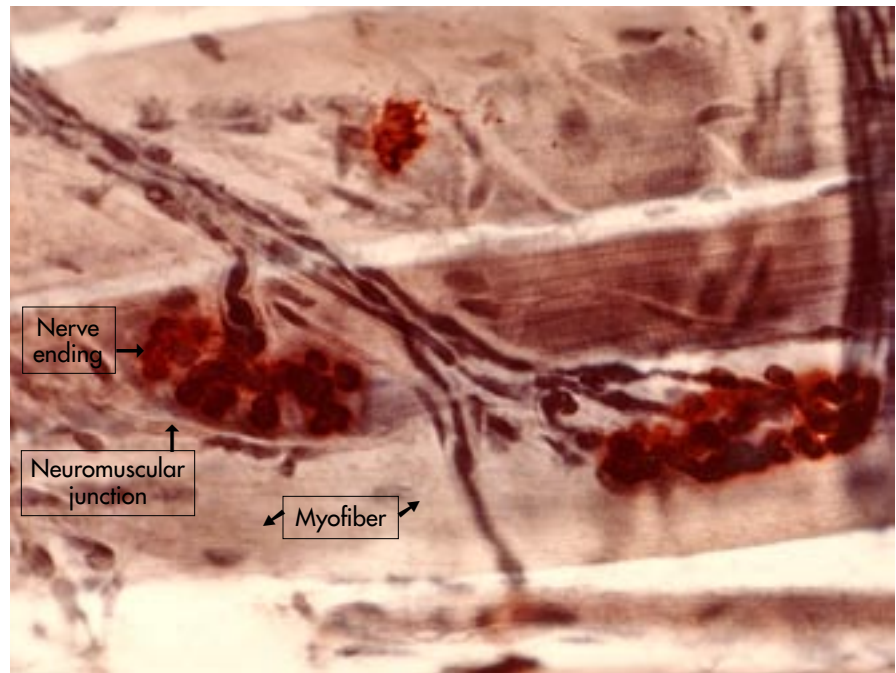


Muscle biopsy from a horse with polysaccharide storage myopathy (PSSM).



Muscle biopsy from a homozygous horse with hyperkalemic periodic paralysis (HYPP).

developed MH characteristic features that included hypercapnea (excess carbon dioxide in the blood), hyperthermia, excessive perspiration, and muscle rigidity while under halothane anesthesia. Muscle samples were analyzed histochemically, and nonspecific findings such as muscle fiber size variation, central nuclei, hypercontracted fibers, and areas of glycogen depletion were observed. Genetic testing revealed that the mutation in MH horses was altering gene function as described in other species. Based on this study, a screening test is now available for horses suspected of having EMH, although it is unknown whether the mutation is responsible for all cases of EMH. ✱



Motor unit showing nerve ending, neuromuscular junction, and myofiber. The skeletal muscle is composed of muscle cells or myofibers. Each myofiber is stimulated by a motor nerve that derives from the spinal cord. The junction between a nerve ending and a myofiber is called the neuromuscular junction. Abnormalities or diseases could occur at the nerve (neuropathy), neuromuscular junction (neuromuscular disorder), or muscle (myopathy) level. Muscle atrophy could occur secondary to a neurological problem.

Classification of Myopathies

The origin of various myopathic disorders can be attributed to abnormalities involving the following anatomic areas:

Spinal Cord

Equine motor neuron disease (EMND) in Quarter Horses and other breeds

Peripheral Nerve

Trauma
Neoplasia
Degenerative

Neuromuscular Junction

Myasthenia gravis
Immune-mediated

Skeletal Muscle

Recurrent exertional rhabdomyolysis (RER) in Thoroughbreds
Other exertional rhabdomyolysis in other breeds
Polysaccharide storage myopathy (PSSM) in Quarter Horses, Draft horses and other breeds
Glycogen branching enzyme deficiency (GBED or glycogenosis type IV) in Quarter Horses
Hyperkalemic period paralysis (HYPP) in Quarter Horses and related breeds
Pituitary pars intermedia dysfunction (PPID) associated myopathy in several breeds
Malignant hyperthermia (MH) in several breeds
Mitochondrial myopathy associated with complex I deficiency reported in one Arabian filly
Infectious (*Clostridium* spp., *Streptococcus* spp., others)
Immune-mediated (*Streptococcus* spp., *Corynebacterium pseudotuberculosis*, influenza, vaccinations)

Diagnostic Work-Up for Muscle Disorders

When It's Needed, What's Involved

A complete muscle workup may be indicated if your horse shows repeated clinical signs of stiffness, weakness, cramps, myalgia (muscle pain), unexplained or unusual gait/lameness, exercise intolerance, colic-like symptoms or unusually elevated heart rate associated with exercise. Be aware also that muscle conditions can develop after anesthesia or trauma.

A complete general physical examination should be done to assess the rest of the body systems and determine whether other organs are involved or are contributing to the myopathic process. The physical exam will also rule out other causes for the patient's clinical signs. A more specific skeletal exam should include inspection, palpation and percussion of the musculature. In addition, laboratory tests, an exercise tolerance test, and muscle biopsy must be performed if indicated.

Laboratory Tests

Basic blood work consists of a complete blood cell count (CBC) and biochemistry panel. Some examples of specific tests to assess myopathies are creatine kinase (CK), aspartate amino transferase (AST), lactate dehydrogenase (LDH), pyruvate/lactate, blood gases, myoglobin, vitamin E/selenium, and fractional excretion of electrolytes. While an elevated serum CK may be indicative of muscle problems, a normal serum CK does not rule out muscle disease but indicates that there is no muscle necrosis as seen with various types of rhabdomyolysis. Endocrinopathies (disorders of the endocrine system, hormonal imbalances) such as pituitary pars intermedia dysfunction (PPID) and hypothyroidism may present with muscle-associated problems and should therefore be analyzed. Specific myopathies of neuromuscular or neurogenic origin must be studied with the appropriate diagnostic techniques.

Exercise Tolerance Test

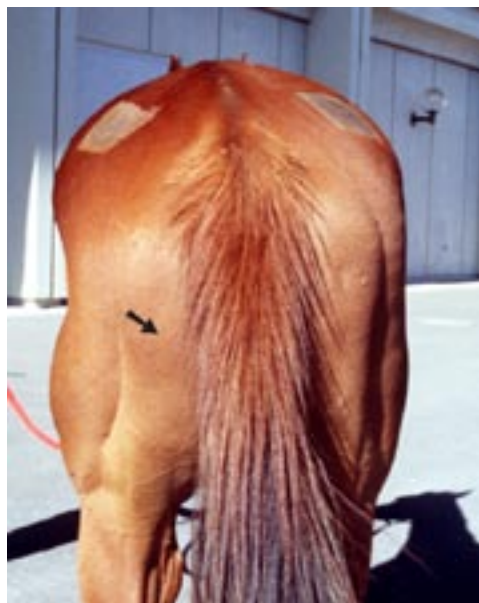
This test is useful for identifying chronic or recurrent rhabdomyolysis such as polysaccharide storage myopathy (PSSM) or recurrent exertional rhabdomyolysis (RER). This test could be performed with a lunge line or in a treadmill. Physiological (heart and respiratory rates, body temperature, mucous membranes) and laboratory (electrolytes, blood gases, lactate/pyruvate, muscle enzymes) parameters should be monitored before and after exercise. This test consists of 3 to 5 minutes of walking and 13 to 15 minutes of light trotting. The horse must not be forced to exercise if signs of stiffness, muscle cramps, flaring nostrils, or

exercise intolerance are observed. Creatine kinase should be measured before and 4 to 6 hours after exercise. It is important to emphasize that not all myopathies present with elevations of muscle enzymes.

Muscle Biopsy

The appropriate muscle specimen to collect will depend on the clinical condition of the patient. If a generalized/diffuse myopathy (rhabdomyolysis) is suspected, any muscle could be sampled, whereas in focal myopathies caused by trauma or infection, the affected muscle must be collected to ensure a diagnostic specimen. The muscle biopsy should be obtained from a muscle that is definitely affected but not so severely wasted that much of it is replaced by fat or fibrous tissue. Ideally, the muscle should be one that has not been traumatized by injections or electromyographic (EMG) studies.

In the horse, the gluteal muscle is routinely biopsied due to the ease of collection and because it is the most studied muscle. This muscle is useful for diagnosing exertional rhabdomyolysis or compartmental syndrome and in sampling recumbent horses, because this is a deep muscle where more severe changes are usually found (ischemia, hypoxia). Other muscles that are often sampled include the semimembranosus muscle and the sacrocaudalis dor-



The shaved areas show where the gluteal muscle biopsy is taken. The arrow shows where a biopsy would be taken of the semimembranosus muscle.



Bergstrom needle biopsy for gluteal muscle biopsy.

salis muscle. The semimembranosus muscle also is used to diagnose exertional rhabdomyolysis, including polysaccharide storage myopathy. The sacrocaudalis dorsalis muscle is the preferred muscle for the diagnosis of equine motor disease because it is composed of at least 20 to 30% of slow twitch fibers which are the most severely affected in the disease.

Tests run on muscle biopsy samples include specialized staining for histochemical (chemical components or enzymatic activities of cells) and immunohistochemical analyses and sometimes electron microscopy. In some patients, electrodiagnostic analyses are also employed as well as testing for malignant hyperthermia.

Contact at UC Davis

For more information on muscle conditions in horses, or for specific information on obtaining a muscle biopsy for analysis at the UC Davis Neuromuscular Disease Laboratory, contact Dr. Monica Aleman at (530)752-1170 or 752-7267, or e-mail her at mraleman@ucdavis.edu.

Referred samples are accepted from veterinarians not only from within the state but from other parts of the country and internationally. Telephone consultations can be conducted. Before samples are sent to the lab for analysis, contact Dr. Aleman in writing or by phone to receive appropriate instruction on how and when to send the samples. Samples are analyzed and results reported in five to seven working days. ✱

Dr. Monica Aleman, Specialist in Neuromuscular Diseases of Horses



Dr. Aleman with Hilde.

She is not much taller than the little two-week-old Belgium Draft horse foal she stands next to but Dr. Monica Aleman's accomplishments would likely outweigh the foal's mare if one could assign such a value to intellectual production. As the newest faculty member in the UC Davis School of Veterinary Medicine, Dr. Aleman has an appointment that is half clinical and half research—the best of both worlds. She received her Doctor of Veterinary Medicine degree from the National Autonomous University of Mexico in 1991, followed by board-certification by the American College of Veterinary Internal Medicine and, most recently, completion of a PhD in comparative pathology from UC Davis. Dr. Aleman has a particular interest in the equine skeletal muscle system and has done considerable work over the last four years in the Neuromuscular Disease Laboratory. Her PhD thesis was on equine malignant hyperthermia, a life-threatening pharmacogenetic disorder of the skeletal muscle. This disease was previously confirmed to have a genetic basis in humans, pigs and dogs but not in horses. Dr. Aleman's research confirmed the genetic basis in horses and resulted in a screening test for susceptible animals. Now that she has completed her doctorate, we are thrilled to have Dr. Aleman as a permanent faculty member.

DONOR SUPPORT

The Center for Equine Health at UC Davis has successfully established several awards in support of its research, educational and service activities. These endowments are essential to stimulating collaborative efforts toward the current and long-term success of the CEH. We are proud to announce the following award recipients for 2005:

Dr. Susanne Dykgraaf - Dan Evans Memorial Endowment

Dr. James Brown and Dr. Michelle Delco - John P. Hughes Memorial Endowment

Dr. Stephanie Bell and Dr. Mathilde Leclerc - Peray Memorial Endowment

A description of the research made possible by these endowments follows. Congratulations to Drs. Dykgraaf, Brown, Delco, Bell, and Leclerc!

Dan Evans Memorial Endowment

Dr. Susanne Dykgraaf is the recipient of this year's Dan Evans Memorial Endowment. Her research will involve study of the fetlock joints of racehorses that have died on California racetracks to determine whether there is a relationship between injury to the proximal phalanx and changes to other fetlock joint structures. The study will also characterize the types and configurations of proximal phalanx fractures in these horses and examine the contralateral limb for similar pathologic changes.

Hyperextension of the fetlock joint of racehorses during galloping leads to site-specific injuries of the proximal sesamoid bones, cannon bone condyle and suspensory ligament. These injuries are believed to be the result of accumulated micro-



Dr. Susanne Dykgraaf

damage sustained by musculoskeletal tissues during training and racing. However, the association between proximal phalangeal fractures—another component of the fetlock joint—and other site-specific joint injuries is not known. It is hypothesized that horses that sustain injury to the proximal phalanx have concurrent articular cartilage, soft tissue or bony changes of the structure of both the affected fetlock joint and the fetlock joint of the opposite limb.

Proximal phalanx fractures occur commonly in racing Thoroughbred horses, but the incidence and cause or origin of these fractures are not known. They may be similar to condylar fractures in that they are related to cumulative microdamage, ultimately leading to catastrophic failure. If the incidence of these fractures and the risk factors leading to fracture are identified, they may be preventable.

John P. Hughes Memorial Endowment

This year's John P. Hughes Memorial Endowment was awarded to two researchers conducting two very different studies, Dr. James Brown and Dr. Michelle Delco.

Dr. Brown will be investigating the effects of increasing insemination frequency of subfertile stallions on sperm numbers in the oviducts of mares. Subfertility in stallions is

commonly associated with a normal percentage of motility but with a low number of morphologically normal sperm. During migration of sperm from the uterine body to the oviduct, only motile, morphologically normal sperm pass through the utero-tubular junction. Therefore, low numbers of sperm from subfertile stallions are recovered from the oviduct compared with fertile stallions. We hypothesize that by increasing insemination frequency, the number of sperm from subfertile stallions at the utero-tubular junction will sufficiently increase to allow more motile, morphologically normal sperm in the oviduct.

Subfertility in stallions is of significant economic significance to the breeding industry in terms of lost genetic value and efforts and expenses involved in repeatedly breeding mares. Since subfertility in stallions is nonreversible, management strategies are the cornerstone of treatment. This project will contribute knowledge for the management of these stallions.



Dr. James Brown

Dr. Delco will investigate a recently approved medication, Tegaserod, to determine whether it is absorbed after oral administration in horses showing clinical signs of small intestinal ileus, a common complication after colic surgery. Tegaserod has been shown to be safe and effective in stimulating bowel motility in various species, including normal horses.

However, we do not know if this medication can be absorbed when administered orally to horses showing clinical signs of small intestinal ileus (i.e., producing gastric reflux).



Dr. Michelle Delco

It is believed that horses with ileus may be unable to absorb orally administered Tegaserod due to refluxing of fluid into their stomachs from the small intestine (where the drug would normally be absorbed). However, there are no reported studies that have investigated the absorption of such drugs administered orally to refluxing horses. It is possible that Tegaserod could be absorbed in the proximal small intestine of refluxing horses if it is administered orally immediately following decompression of the stomach. If we can determine that it is well absorbed in a small number of clinical cases of ileus, we could proceed to investigate the use of this medication in horses being treated for other motility disorders or test the pharmacokinetics of other drugs administered orally to refluxing horses.

Peray Memorial Endowment

Dr. Stephanie Bell and Dr. Mathilde Leclere are the recipients of this year's Peray Memorial Endowment. Dr. Bell and Dr. Leclere will investigate the prevalence of adenoviral infection, which causes respiratory

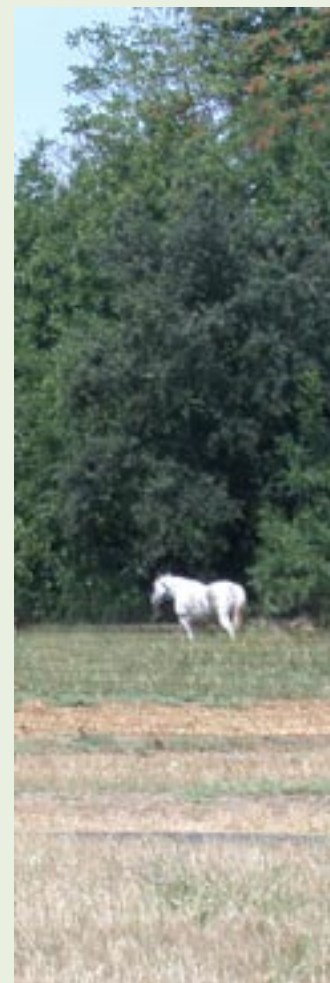
disease, in hospitalized and normal foals.

Adenoviral infections are a cause of respiratory disease in foals, especially those that are immunocompromised. However, the prevalence of adenoviral infections in specific foal populations has not been investigated. A Thoroughbred foal with pneumonia recently hospitalized in the neonatal intensive care unit (NICU) had unequivocal evidence of adenovirus, which may indicate that such infections are a more important problem in this population than previously thought. The research hypothesis is that adenoviral infection is more prevalent in foals with respiratory disease hospitalized in the NICU than in hospitalized or nonhospitalized foals without respiratory disease.



*Dr. Mathilde Leclere (left) and
Dr. Stephanie Bell*

Viral respiratory disease is an important problem in the equine industry, especially in foals and young performance horses. While adenoviruses have been implicated in the pathogenesis of respiratory disease, they have not been extensively studied except in Arabians with severe combined immunodeficiency or Fell Ponies with immunodeficiency syndrome. This study will help to clarify the significance of equine adenoviruses as a cause of respiratory disease in high-risk populations of foals. ❄



*I shall be telling this with a sigh
Somewhere ages and ages
hence:
Two roads diverged in a wood,
and I—
I took the one less traveled by
And that has made all the difference.*

*Robert Frost
from **The Road Not Taken***

New Equine Athletic Performance Laboratory to Benefit Research on Performance-Related Problems in Horses

On May 2, the Claire Giannini Hoffman Equine Athletic Performance Laboratory will be dedicated at the UC Davis School of Veterinary Medicine. The 10,000-square-foot laboratory is named in honor of Claire Giannini Hoffman, an avid horsewoman and animal lover, particularly of horses and dogs.

The Giannini Laboratory is located just west of the Veterinary Medical Teaching Hospital, immediately adjacent to the Large Animal Clinic. It has over 6,000 feet dedicated to animal and analytical laboratories, offices, instrumentation rooms, horse preparation areas, and two rooms each housing a Swiss Mustang 2200 motorized

equine treadmill. These treadmills are among the most sophisticated in the world today, reaching racing speeds of over 37 mph. The treadmills were specially built to allow horses to run either uphill or downhill, as well as on the level. Downhill treadmills are extremely unusual and allow certain types of experiments to be conducted using muscles in ways that cannot be

duplicated by other means.

The new Equine Athletic Performance Laboratory (EAPL) will serve as a center for research into the pathophysiological basis of diseases and problems that afflict equine athletes. It will allow researchers to develop new and refined diagnostic techniques for evaluating these problems and implement new therapeutic

As part of the laboratory's mission to develop new diagnostic and therapeutic approaches to performance-related problems, the laboratory will interface with researchers in a number of scientifically related disciplines, including cardiovascular and respiratory physiology and medicine, biomechanics (J.D. Wheat Veterinary Orthopedics Laboratory), pharmacology and drug effects

(Equine Analytical Chemistry Laboratory), and evaluation of muscle structure and function—the basis of exercise performance—by the Neuromuscular Disease Laboratory. Dr. Monica Aleman will spearhead the latter effort by applying sophisticated analytical techniques to assess changes in the skeletal muscle of



The new Equine Athletic Performance Laboratory will offer two Swiss Mustang 2200 motorized equine treadmills for evaluating performance problems and implementing new therapeutic approaches for treating them. These treadmills are among the most sophisticated in the world today, capable of reaching racing speeds of over 37 mph.

approaches for treating them. At the same time, a portion of the laboratory is dedicated to providing diagnostic services to clients of the Veterinary Medical Teaching Hospital who have horses with performance-related problems. The laboratory will provide a focal point for establishment of a new Equine Performance and Sports Medicine clinical program.

horses with performance problems. Added to the broad range of other components that the EAPL will be capable of analyzing (heart, lungs, metabolism, gait, imaging), Dr. Aleman's work in determining the changes in muscle that contribute to a horse's performance problems will be invaluable.

A Prince of a Story

Not too long ago, Dr. Peter Heidmann and Dr. Nicola Pusterla of the UC Davis Veterinary Medical Teaching Hospital were presented with a 13-year-old Quarter Horse gelding exhibiting signs of muscle wasting and neurological deficits. "Prince" was given an extensive physical exam that revealed marked symmetrical atrophy of the muscles of his hindquarters, a lack of coordination, and a "stringhalt" like gait that worsened with excitement.



Since "Prince" exhibited a variety of signs that appeared to be of multiple origin, a neurological consult was requested.

Dr. Monica Aleman and her Neuromuscular Disease Laboratory staff were called on to help sort out this rather strange and somewhat confusing mix of disease signs. Their initial examination showed that Prince had a hard time figuring out where all four of his feet were at any given time and that he had a severe hypermetric (exaggerated) gait of his hind limbs. Further exploration proved that he also had signs of muscle wasting in his neck and pain associated with manipulation of his cervical spine.

Radiographs of his neck revealed evidence of arthritic changes in some of his cervical vertebrae. While this could be the cause of some of his gait problems, the radiographs alone could not prove that and further diagnostic steps were taken. Electromyography of several muscles, using electrodes to record electrical activity, revealed abnormal responses and impaired muscle function. Moreover, spinal fluid taken for analysis was positive for *Neospora hughesi*, which is one of the protozoa responsible for equine protozoal myelitis (EPM). The muscle enzymes creatine kinase and aspartate aminotransferase were slightly elevated, but the results of Prince's muscle biopsies were the most revealing. All of the muscles of his body that were sampled showed marked abnormalities, including polysaccharide

inclusions, neurogenic microfiber atrophy, and muscle fiber necrosis.

Poor Prince was suffering from a multitude of sins! He had polysaccharide storage myopathy (PSSM), EPM caused by *Neospora*, and cervical spinal arthritis. Fortunately, since all his problems rather than just one had been uncovered, he could now be treated appropriately and effectively. Prince was started on a course of medical therapy that included antiprotozoal treatment against *Neospora*, nonsteroidal anti-inflammatory therapy for his



Prince when he arrived at the UC Davis Veterinary Medical Teaching Hospital.

spinal arthritis, and a controlled diet and modified exercise regime for his PSSM. He responded well to therapy and was able to return home. His owners report that he is currently doing well. One big victory for Prince; one small victory for the science of neuromuscular disease management.



Prince today.

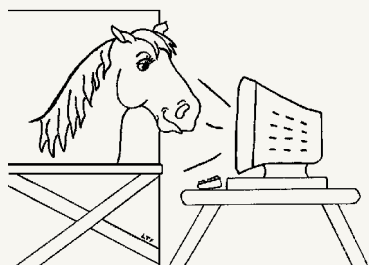
COMING EVENTS

Equine Emergency Symposium at UC Davis on May 14, 2005

The Student Chapter of the American Association of Equine Practitioners at the University of California-Davis will present an Equine Emergency Symposium on Saturday, May 14, 2005. The day-long event will be held at the School of Veterinary Medicine, with lectures in 170 Schalm Hall. The morning session will feature noted faculty from the School of Veterinary Medicine speaking on various topics, followed by a question/answer session. Speakers will emphasize what to do before your veterinarian arrives in such emergencies as fractures, lacerations, poisoning and colic. In the afternoon, participants will try their hand at bandaging and learn about proper splint placement and "down horse" rescue, as well as collect and take home the components of a well-stocked first-aid kit.

The cost of the symposium is \$85.00 per person, payable by check or money order made out to the Equine Medicine Club. For registration information or a flyer detailing the activities of the day, send an e-mail to ucdavisquinemedicineclub@yahoo.com or contact Maureen Kelleher at (530)979-1630. Registration is due by May 6, 2005, and attendance will be limited to the first 200 registered participants.

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