The Equine Health Program at North Carolina State University’s College of Veterinary Medicine brings together horse owners, veterinarians, and CVM faculty on the issues, research, and advancements concerning horse health in North Carolina and beyond.

www.cvm.ncsu.edu/docs/ehp.html
To all of you interested in equine health,

As the current head of the Department of Clinical Sciences, one of my principal goals is to grow the equine health program in order to service horses and their owners throughout the state. We have several important missions, including research, teaching, and clinical service. We provide service for horses in need of advanced medical and surgical care. We also have services focused on reproduction, podiatry, and ophthalmology which have grown dramatically in the recent past, and clearly set us apart from other veterinary colleges. We teach our students in the lecture theaters; but more importantly, also while seeing horses that are referred to the Veterinary Teaching Hospital. We also base our research programs on medical and performance problems we see in horses that are presented to us. We have tremendous clinically-applicable studies assessing lameness, colic, advanced reproductive technology, respiratory disease, and eye diseases all of which have relevance to the horses of North Carolina. Examples of current investigation include suspensory ligament injury, use of pain killers to treat colic, embryo transfer technology, treatment of moon blindness in horses, and treatment of heaves in horses. The only limitations to finding new diagnostic techniques, developing new treatments, and increasing our ability to breed the best sport horses in the country are the numbers of hours in the day our faculty have to do their research and the funds required to continue this research.

If you have any interest in contributing to our research efforts in any way, please do not hesitate to contact me at 919-513-6230 or Anthony_Blikslager@ncsu.edu

Very best wishes to you and your horses

Anthony T. Blikslager, DVM, PhD, Diplomate ACVS
Interim Head, Department of Clinical Sciences
Associate Professor, Equine Surgery
Letter from Director of Outreach

To Horse Owners of North Carolina,

Last year when I wrote my report letter, it was post-Katrina and this year just after the Apex, NC hazardous materials situation. Each disaster only reinforces the need for every family to have their own emergency plan for themselves, their small animals, and their horses and other livestock. Meet with your neighbors and develop a plan.

My career has been primarily involved with clinical equine practice, but I have always felt that advancement of horse health will come from the cooperative efforts of horse owners, practicing veterinarians, and veterinary researchers. During the past two years, I have been a member of the American Association of Equine Practitioners’ Equine Research Coordination Group. This national group was formulated to work at helping the five national equine research foundations use their research money as efficiently as possible. The goals were to make suggestions on how to:

1. Increase research needs awareness among horse owners and the public
2. Increase ways to encourage young scientists and veterinarians to consider equine health research as a career

It is important for each person interested in horses and horse health to be concerned about how research will move forward. North Carolina is unique in that it is the only state without horse racing that is ranked in the top 10 in horse population. Racing, through a percent for the betting handle, is the financial engine of each of the other nine states’ equine health research.

This year in North Carolina, two small but very important steps were taken to help equine research.
1. The legislature undertook the most extensive ever study of the North Carolina horse industry, including hearing of its contributions to the state’s economy, and its needs.
2. The North Carolina Horse Council reinstated their competitive grant programs, which can include health research grant submissions.

The following pages have information about the research that is currently being undertaken at your College of Veterinary Medicine which is the main deliverer of equine health research in North Carolina. If you have any questions, give me a call at 919-513-0035 or email me at dick_mansmann@ncsu.edu.

Best of luck with your horses (and emergency planning) in 2007!

Richard A. Mansmann, VMD, PhD
Director of Outreach, Equine Health Program
How we keep apprised of the newest treatments in equine care.

(Without losing sight of the oldest.)

Fortunately for horse lovers, the science of equine healthcare is advancing rapidly. Problems that were unsolvable only a few years ago are now yielding to new techniques and treatments. Here at North Carolina State University’s College of Veterinary Medicine, we have made it our mission to not only offer the latest in equine medical care, but to help discover it as well.

Our determination to lead the field has attracted some of the top equine specialists from around the world. Here, they help advance their specialties by employing and improving the very latest technologies.

This commitment has led to our school being the first in the nation to initiate surgical laser treatment for horses with upper airway problems. Our researchers have spearheaded the nation’s most comprehensive program for assessing the causes and treatment of colic. Our center is one of only two in the country with an MRI unit large enough to scan a horse lying down. And it’s one of only a handful of equine health centers that offers full-time ophthalmology services.

What drives these achievements is not only a commitment to excellence, but an abiding respect for and love of horses. That’s why we never consider our treatments complete unless they include heavy doses of TLC.

For more information or to make a tax deductible contribution, call 919-513-0035.

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Scholarships for equine oriented veterinary students

2006 represented a continued growing year for scholarships. Over the past several years, the Raleigh Spring Premiere Horse Show (March 29-31, 2007 at the James B Hunt, Jr Horse Complex), with its show manager, Mr. Ray Cloninger, and the North Carolina Hunter Jumper Association both have an endowed scholarship. These two organizations have expanded their financial gifts to students by placing half their donations into their endowments and half of their donations directly to students so two students benefit. These two organizations join the Randal B. Terry Thoroughbred Racing endowed scholarship for equine oriented students. Also, in recent years, the North Carolina Thoroughbred Association has given $1000 for a student. These scholarships help equine oriented College of Veterinary Medicine students:

1. Reduce their average $70,000 educational debt as they start their careers helping horses with their health issues
2. Reduce an individual’s debt so they are not tempted to go into a more lucrative small animal practice situation (small animal average salaries are higher for new graduates than the first five year salaries in equine practice. After that equine practice salaries catch up to other veterinary discipline salaries).

Besides $25,000 endowed scholarships, other ways veterinary practices, groups, or individuals can help students:
Any veterinary practice, horse organization, or individual can make any donation to be given to a deserving equine oriented student or given to a specifically named student.
So, a veterinary practice interested in recruiting an individual could help that individual.
A horse organization could help a member that is a veterinary student with a named scholarship.
We have also had horse shows name a scholarship as a benefit.

If you have questions about scholarship donation, please call 919/513-6427 or email Allison_Crouch@ncsu.edu

Students receiving rescue training
Drug Companies Involvement with Our Equine Health Program

This year, we have worked at strengthening our rapport with our Equine programs to various companies that have significant connections to the horse industry. These companies produce FDA approved drugs, vaccines, researched feed and supplements. Besides the interaction of faculty, horse owners and practitioners, the foundation of our expanded acronym has to be the cooperative efforts between education and business for horse health. Certainly, our classic partnership here at the College of Veterinary Medicine has to be the Iams Equine Imaging that allows horse owners and their veterinarians the opportunity to have a high field MRI here in our practice area.

We have worked to enhance our 23rd Annual Equine Medicine Symposium to be held February 24-25, 2007 for Veterinarians on Saturday and Horse Owners on Sunday with sponsorships. These companies have provided educational exhibits for the attendees. Having horse owners meet with the experts from the companies that produce excellent drugs, feed, and materials that help their horses stay healthy is important. We have had other company partnerships with a sponsored vaccination clinic for students and staff and help with other educational and research programs.

The following is a list of companies who have supported some phase of our equine programs:

- Luitpold
- Boehringer Ingelheim
- Nutrena-Cargill
- Platinum Performance
- Southern States

- IDEXX
- Merial
- Intervet
- Purina
Veterinary Research Training Programs: Training the Veterinary Clinician Scientists of Our Future

Two reports from the National Research Council entitled ‘National Needs and Priorities for Veterinarians in Biomedical Research’ and ‘Critical Needs for Research in Veterinary Science’ have carefully documented the growing deficit of veterinary researchers in the face of increasing national need and demand from both academia and industry. This need arises from an awareness that veterinarians are uniquely qualified to participate in research involving animals. Through their clinical training, veterinarians have an appreciation for the animal as a whole. Veterinarians also come to appreciate common themes that transcend the numerous species they encounter clinically and they embrace the concept of ‘One Medicine’. The College of Veterinary Medicine (CVM) is committed to addressing both the growing national need for veterinarians trained in biomedical research and the shift in emphasis toward multidisciplinary approaches to translate advances in research to the clinical setting. The spectrum of research training opportunities available to pre- and post-DVM students at NC State is evidence this commitment.

The College has a four-pronged approach to advancing research training for veterinarians that are brought together under the Clinician Scientist Training Program umbrella. The purpose of the Clinician Scientist Training Programs is to increase the visibility and development of the individual programs. A Director of the Clinician Scientists Training Programs will be appointed to oversee the programs, market the programs and recruit trainees, serve as an advocate for the trainees, coordinate the clinical and research training of the individuals in the programs, and expand fund raising through grant writing and development efforts.

The Programs

The first program is a well-established and very successful summer research internship program that allows first and second year veterinary students to work with a faculty mentor in a productive laboratory setting. This program is aimed at providing a “taste” of veterinary research for those students without significant prior experience. There are over 100 alumni of this program in the past 5 years alone. Many go one to seek additional clinical and/or research training. Many do not, but take with them into their private practice careers a deeper understanding of veterinary research and incorporate those principals into the care of their patients.

The second is the newly created research-intensive focus area for veterinary students who wish to incorporate significant research into their DVM degree program. This program allows time in the summers and the senior clinical year to work extensively in a laboratory and offers courses during selective periods to provide exposure to the fundamental principles of research for veterinarians.
The third is a newly established combined DVM/PhD training program. This program is designed to admit very talented students who already know they want to incorporate research into their career goals. The combined DVM/PhD program provides financial support to attract the most talented students possible to enrich our pool of trainees and integrates research and clinical training to ultimately produce better clinician scientists and to reduce the overall time required to complete both degrees.

The fourth is a college-wide program for residents who seek intensive training in basic research coupled with their post-graduate clinical training program leading to board certification in their specialty. Most of these individuals will obtain a PhD, but some will use this mechanism to obtain research training for 1-2 years in a Fellowship type program. Several groups within the CVM, notably the Equine group and the Small Animal Internal Medicine group, have historically been very committed to residency/PhD training. To date, the CVM has provided combined residency/PhD training for 40 individuals, most of whom are the teaching and doing research in veterinary schools across the country and throughout the world. Indeed, 9 of the alumni of our residency/PhD programs are currently on the faculty at the CVM.

Impact of These Training Programs on Equine Veterinary Student Training

Like other veterinary disciplines, equine veterinary medicine is faced with a shortage of veterinarians trained in research. The importance of research training is not only in producing researchers that work on problems related to equine health and welfare, but also to enrich our students who enter equine practice with knowledge of veterinary research that equips them to better understand diseases and their treatment and to make better use of new information that is being produced every day by equine veterinary research. The equine group at NC State is very involved in all four of the training programs that provide research experience and training to veterinary students.

Summer Research Internship Program: Each year, 4-5 students in the summer research internship program work with equine faculty mentors. The members of the equine faculty are well represented in the program; Dr. Sam Jones, Dr. Anthony Blikslager, Dr. Carlos Pinto, Dr. Sarah Gardner, and Dr. Betta Breuhaus are recent mentors who have trained students in the program.

Marsha McDowell and Jennifer Jones-Shults worked with Dr. Blikslager this past summer on a project examining the effects of lidocaine IV infusions on the intestine damaged in a model of strangulating colic. Their work demonstrated that lidocaine infusion do indeed reduce the damage, reduce inflammation, and hasten repair in the equine intestine. This work will have an immediate impact on the treatment of colic because lidocaine IV infusions are already used to treat many of these patients. This work provides critical evidence supporting the use of this therapy.
Jennifer Bell worked with Dr. Sam Jones to study the mechanisms by which endotoxin trigger inflammation, a key feature of the highly fatal condition called endotoxemia in horses with colic and other severe diseases. Jennifer discovered that a drug that inhibits a molecule called p38 blocked the ability of endotoxin to induce the expression of a number of pro-inflammatory mediators in blood cells that are responsible for the inflammatory response in endotoxemia. Here work demonstrates that drugs that inhibit p38 may be useful new therapies for endotoxemia in horses.

Megan Alley worked with Dr. Breuhaus to characterize the sugar metabolism defect in geriatric horses with metabolic syndrome. This devastating disease, often leading to laminitis (founder) is poorly understood in horses and there is no known treatment. Megan compared the insulin sensitivity of horse breeds that seem "prone" to equine metabolic syndrome, such as Paso Finos and American Saddlebreds, to breeds that are not, such as Standardbreds and Thoroughbreds. While the results of this study are not yet final, Megan expects the information will be better able to inform veterinarians and owners of management strategies that will prevent metabolic syndrome in horses more prone to developing such conditions.

Jennifer Lowry worked with Dr. Carlos Pinto to examine the utility of sequential transrectal ultrasonography as the sole method of estrus detection in mares. The results of this study suggest that this method of estrus detection is useful for monitoring cycling mares without the concurrent use of teasing or progesterone assays.

**Combined DVM/PhD program:** Adam Moeser recently finished his thesis work leading to the PhD degree in Dr. Anthony Blikslager’s laboratory. Adam will finish his program in the spring of 2008 and is expected to remain in an academic position continuing to perform veterinary research. Adam has identified a critical pathway that is essential for the recovery of the intestinal mucosal lining after injury. He has characterized a drug that hastens the repair of the intestinal mucosa. This drug holds promise for the treatment of types of severe colic in horses that have the highest fatality rates.

**Residency/PhD program:** Over the years, 8 equine medicine or surgery residents have been or are currently being trained in this program. All that have completed the program (6) have gone on to be board certified in their specialty and received a PhD and are now faculty members at veterinary schools across the country. Indeed, Dr. Anthony Blikslager, Dr. Jennifer Davis, Dr. Nigel Campbell, and Dr. Dianne Little are currently on our faculty at NC State and are not only doing clinical work in the Veterinary Teaching Hospital, but are also directing research programs of their own in Physiology, Pharmacology, and Comparative Biomedical Sciences. This program has the greatest impact on producing the next generation of Clinician Scientists of all in our training program.
Financial Support for the Training Programs: The Fund for Discovery

Funding the students in these training programs is a challenge. The Fund for Discovery was established by a generous gift from Ms. Deborah Resnick. Over the years, the Fund for Discovery has supported over 20 DVM students in our summer research internship program. The College of Veterinary Medicine and the North Carolina Veterinary Medical Foundation, announce that The Fund for Discovery will now serve as a platform to provide DVM and graduate students, residents, and postdoctoral associates with funding to seek research training to produce the next generation of clinician scientists. Furthermore, this funding will help support the research projects themselves, allowing research in areas that are critical for animal health and welfare, but are currently of low priority for federal granting agencies.

The first essential priority is to provide stipend and tuition support for students in the individual Clinician Scientist Training Programs. The Fund for Discovery currently supports 3-4 summer research internship positions. This support will continue and the intent is to increase the number to 5. We also seek funds to support students in the research-intensive focus area during the summers and to allow them the opportunity to take a year off from the DVM curriculum to immerse themselves in a research lab. Stipend and tuition support is also needed for Combined DVM/PhD program students and students in the residency/PhD training programs.

The second essential priority is to increase the funds available for research projects in all four programs. Internal funding for research will not only provide desperately needed resources in a time when funding is difficult to obtain from federal sources and foundations, but will also allow students and mentors to think Outside The Box, test novel ideas and undertake unique research leading to breakthrough discoveries in animal health and welfare.

The funding provided by the Fund for Discovery will have a great impact on research training for equine veterinary students and residents. Donations to this fund may be unrestricted or earmarked for those students working on equine projects, depending on the preference of the donor. For more information on the Fund for Discovery, please contact:

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Director, Clinician Scientist Training Programs
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Raleigh, NC 27606
Phone: 919-513-7722
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NEW SERVICE: EQUINE PODIATRY

November 1, 2005, the College of Veterinary Medicine started a podiatry service within the Equine Health Program and the Veterinary Teaching Hospital. It was the third outreach service offered at the newly renamed Equine Health Center in Southern Pines, along with the Reproduction and Ophthalmology Services. It also was to function part-time in the Veterinary Teaching Hospital in Raleigh. With the help and hard work of farrier Kurt vom Orde, we are able to provide a full-service exam and shoeing in one appointment. The specific goal of the service is to provide veterinarians, farriers, and horse owners a concerted farrier-veterinary effort at evaluating the horse’s foot conformation in relationship to the rest of that horse’s conformation and mechanically make the adjustments as necessary to make that abnormal conformation more normal and hopefully reduce pain.

Certainly, most horse owners, veterinarians, and farriers believe “no hoof, no horse.” However, very little research and medical attention has been directed towards the horse’s foot. Foot problems in the horse can have as wide a range of severity as any other equine medical problem. For instance, there can be mild colics that go unobserved to colic problems that have the potential of causing death. Certainly a severely colicky horse attracts a significant amount of attention, just as severe laminitis. So, also, there can be a significant range of abnormal foot conformation and problems, not just in laminitis, but in long-toe situations, foot separations, blood flow abnormalities, and white line disease, just to mention a few that can become life-threatening.

Over the next three to five years, I would like to see our service develop into a decent program that not only provides excellent clinical service to horse owners, veterinarians, and farriers, but provides good teaching and research programs as well.
We continually want to evolve what the healthy horse hoof looks like. In the summer of 2005, veterinary student Boo Donoho, class of ’08, reviewed the lateral radiographs and information gained in non-lame horses in the Preventive Foot Care Program of the practice I ran previously to accepting a full-time position with the College. The details on how this program was organized were published at the AAEP meeting in 2000. What Ms. Donoho was able to determine was that there are ranges of normalcy in some of the measurements that we examined that appear to fit into some of these observations of other clinicians as to what some normal measurements should be in a horse’s foot (see podiatry abstract).

To evaluate abnormal foot conformation, we will begin by examining past and future cases of various problems that we see and try to lump these cases together so that the mechanical shoeing success or failure in treatment can be evaluated.

Reviewing cases is our primary objective at the Equine Health Center at Southern Pines. This past summer, veterinary student Celeste Barker (class of ’08) examined past cases of horses with hind-limb lameness and sore backs for which altering shoeing is thought to be helpful in their treatment. Also, veterinary student Claire Ecker (class of ’09) was looking at pain in relation to shoeing. We have observed that many horses that require tranquilization for shoeing seem to have foot pain issues that translate into behavioral issues. We are trying to gather information on a number of cases in which the horse that required tranquilization had significant/specific hoof pain. After the pain was diminished or relieved by shoeing, the horse no longer required tranquilization. Also, at our Southern Pines facility, we want to continue reviewing the importance of the positioning of limbs during grazing and what affect that may have on the development on foot conformation.

Our teaching program has also begun. As previously mentioned, students are doing research projects that will eventually be published and can be used in some grant-writing opportunities. For several years, we have been involved with one of the selectives, overseen by Dr. Lola Hudson, where students get some basic farrier information and
spend a week riding with members of the North Carolina Horseshoer’s Association. This past spring, we instituted an advanced podiatry selective where students who have participated in Dr. Hudson’s selective could take on more information in relationship to farriery. Not only is information presented, but practical hands-on experience with shoe removal, trimming, safety around horses, and dealing with a horse’s feet are given to students.

In the Veterinary Teaching Hospital, the primary thrust has been to do clinical work secondary to the needs of the clinicians in the hospital. We have worked with clinicians with laminitic cases, abnormal limb development in young foals, shoeing of lameness cases, etc. Over the past years we have looked at prevention of laminitis in two areas: the first is through supporting Dr. Breuhaus’ endocrine and overweight horse research, which hopefully will lead to ways to prevent laminitis in these horses. Secondly, is to increase awareness of the potential of laminitis as a major secondary problem in colic and endotoxic cases. Within the VTH, there has certainly been a marked increase in the early use of cold therapy in the feet, supportive sole therapy, and use of mechanical elevation of the heel in an effort to reduce the pull of the deep flexor tendon in laminitis suspects. Imaging has also increased, taking earlier digital lateral radiographs in these suspect horses, as well as performing venograms for prognostic and some therapeutic situations in some severe cases.

Our learning curve has been extremely steep during this first year but it also has been extremely exciting. Hopefully, as years go on, we will help more horses. Certainly, we can see the advantage of a conscientious, experienced farrier like Kurt vom Orde working with the veterinarians.

Finally, the two most important messages we have seen that owners can take home and apply to their horses are weight management and moisture control. It is important to keep a horse’s weight down by reducing grain and turnout when the pasture greens-up in the spring and after dry spells. It is also important to keep your horse’s feet dry on rainy days or when there is too much dew. Keeping hose baths to a minimum is also valuable. Remember, the horse is a high desert animal that evolved in an environment of dryness, not in the southeastern geographical conditions with lots of moist pastures with high sugar grasses developed for the fattening of grazing cattle. Good luck. Hopefully, next year’s report will provide you with even more information.

Richard A. Mansmann, VMD, PhD
Colic and Digestive Diseases

Abstracts:

Gerard M, Blikslager A, Roberts M, Allen A. Prospective study of risk factors for the development of ventral midline incisional infection following colic surgery in horses

Cook V, Shults J, McDowell M, Blikslager A. Effects of Lidocaine and Flunixin Meglumine on Recovery of Ischemic – Injured Equine Jejunum

Jones S, Eckert R, Neuder L, Trujillo J, Bell J. Targeting p38 to treat equine endotoxemia
Prospective study of risk factors for the development of ventral midline incisional infection following colic surgery in horses

Description of the Problem:

The ventral midline incision approach is used most commonly in North America to explore the horse’s abdomen for diagnosis and treatment of colic. Emergency colic surgery accounts for approximately 50% of all equine surgeries performed at NCSU-CVM. According to published studies about 25% of horses develop incisional infection following colic surgery. The presence of incisional infection increases patient morbidity and costs of treatment. Risk factors for the development of incisional infection at one surgical facility are not necessarily the same for another due to slight variations in surgical techniques and protocols.

Study Objectives:

- To determine risk factors for the occurrence of incisional infection following an exploratory celiotomy for the diagnosis and treatment of colic in horses at NCSU-CVM

Experimental Approach:

This investigation is designed as a prospective study. Data collection forms were devised and are used to record information on all horses admitted for colic management at NCSU. Horses that undergo surgery for treatment of the colic and that are discharged from the hospital will be included in the study population analysis. The data collection is comprehensive in an effort to record all variables that may influence incisional healing, both intraoperatively and perioperatively. Follow-up phone calls are made to owners after the horse is discharged from the CVM to collect information on any incisional healing complications and postoperative outcome. Risk analyses will be performed when the study population is large enough.
Accomplishments/Results:

- The study was initiated in March 2003 and is currently ongoing.
- Risk analyses require more study population numbers before they can be accurately performed. It is expected that these analyses will begin in the Fall of 2006.
- As of May 2006, a portion of the available rough data is listed below:
  - Since the study began, 331 horses have undergone colic surgery.
  - 24% (79 horses) have been euthanized during surgery.
  - 89% (224/252) of horses who survived surgery have been discharged from the VTH.
  - Currently, 90% (201/224) of discharged patients were alive at last follow up.
  - By six months post-discharge, 12 horses had been euthanized.
  - By one year post-discharge, an additional 4 were euthanized.
  - By year two, 1 horse had died of natural causes.
  - Very approximate, average duration of colic before surgery is 16 hours.
  - 16% of surgical patients have had incisional drainage after discharge from the VTH.
  - Of the colic cases requiring surgery, approximately 35% resulted from diseases of the small intestine, approximately 52% from diseases of the large intestine, and approximately 13% from a combination of the two.
  - Of the cases euthanized during surgery, approximately 48% had colic resulting from diseases of the small intestine, approximately 32% from diseases of the large intestine, and approximately 20% from a combination of the two.

Benefits to the Equine Industry:

Identification of risk factors will facilitate alterations in colic treatment both intraoperatively and perioperatively to help reduce the incidence of postoperative incisional infection. Decreased occurrence of incisional complications will reduce patient morbidity, hospitalization, and treatment costs and therefore improve the overall outcome for horses undergoing colic surgery at NCSU-CVM.
Effects of Lidocaine and Flunixin Meglumine on Recovery of Ischemic-Injured Equine Jejunum

Vanessa Cook, Vet MB, MS, DACVS, DAVECC, Research Associate
Equine Gastrointestinal Physiology

Jennifer Jones Shults, Veterinary Student

Marsha McDowell, Veterinary Student

Anthony Blikslager, DVM, PhD, DACVS, Associate Professor, Equine Surgery

Funded by the Morris Animal Foundation

Description of the Problem

Colic is the principal cause of mortality in horses because of absorption of endotoxin across damaged intestine. In severe colic caused by strangulating obstruction, reduced blood supply causes ischemic injury necessitating surgical resection. However, complete removal of damaged intestine is not always possible, and, with restoration of blood flow, these areas may undergo further damage from reperfusion injury. Recovery of ischemic-injured intestine postoperatively is critical for survival of the horse. Flunixin is an analgesic and anti-inflammatory drug used routinely in postoperative colic cases. However, our previous work has shown that, although an effective analgesic, it retards recovery of the mucosal barrier in ischemic-injured intestine. Therefore, it is crucial to investigate alternative anti-inflammatory agents to increase survival of colic patients.

Study Objectives

- Determine if treatment of horses with ischemic-injured jejunum with intravenous lidocaine restores mucosal barrier function and ameliorates up regulation of inflammatory genes associated with ischemia and reperfusion.
- Determine if treatment with flunixin meglumine retards recovery of mucosal barrier function despite a modest reduction in expression of inflammatory genes.
- Determine if treatment with lidocaine and flunixin meglumine will be more effective than either drug alone on recovery of ischemic-injured jejunum.
Experimental Approach:

Four groups of 6 horses underwent a midline celiotomy and sections of jejunum were subjected to 2 hours of ischemia by temporary occlusion of the local blood supply. At the end of the ischemic event, wedge biopsies were obtained from ischemic and non-ischemic sections of jejunum. Horses were assigned to one of four treatment groups: 1. 10mL 0.9% NaCl IV q 12 hours (control); 2. flunixin meglumine 1 mg/kg IV q 12 hours; 3. lidocaine 1.3 mg/kg loading dose followed by 0.5 mg/kg/min constant rate infusion; 4. flunixin meglumine and lidocaine at the previously mentioned doses. Following recovery from anesthesia, analgesia was provided by butorphanol and horses were monitored for pain using an established behavioral pain scoring system. All horses were euthanized 18 hours following reversal of ischemia and jejunum harvested for the in vitro component of this study. Harvested jejunum was mounted in Ussing chambers for measurement of transepithelial resistance and permeability using fluorescent-labeled E. coli lipopolysaccharide and 14C labeled inulin. Denuded villous surface area, crypt depth, and neutrophils count were measured using histomorphometry. Western blot analyses of expression of COX-1 and COX-2 were performed for all groups. Blood samples were obtained at 0 hours and 8 hours post-ischemia and analyzed for TXB2 and PGE2.

Accomplishments/Results:

This project is ongoing, with the majority of surgeries complete. Data will be analyzed before results are released.

Benefits to the Equine Industry:

We hope that lidocaine will ameliorate the negative effects of flunixin meglumine on ischemic-injured jejunum and improve survival rates of post-surgical colic patients.
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Abstracts:

Barker C, Pinto C, Davis M, Echeyerria K, Whisnant C. Effects of low dose of PGF2α on the mare’s estrous cycle.


Kozink D, Pinto C, Rubio C. Freezing of stallion semen in cryotube vials.
Effects of low dose of PGF$_{2\alpha}$ on the mare’s estrous cycle

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Description of the Problem:

The natural prostaglandin F-2α (PGF2α), dinoprost tromethamine (Lutalyse®), is currently the only PGF2α approved by the Food and Drug Administration for use in horses. A dose as low as 0.5 mg per mare administered as two injections given 24 hours apart has successfully induced luteolysis in horse mares (Irvine et al, 2002), but this protocol requires dilution of the commercially marketed 5 mg/ml PGF2α and incurs additional labor to administer the second dose. Furthermore, horse breeders occasionally have questions as to whether the estrus induced by PGF2α is normal or not.

Study Objectives:

The objective of this study was to evaluate the effects that a single, undiluted low dose of the commercially available PGF2α would have on luteal function and subsequent estrous cycle.

Experimental Approach:

Eleven mares provided 32 cycles that were randomly assigned to the following treatments: Treatment 1 (T1; n = 8 cycles), 2 ml 0.9% saline solution; treatment 2 (T2; n = 6 cycles), 10 mg (2 ml) dinoprost tromethamine (Lutalyse®); treatment 3 (T3; n = 11 cycles), 2.5 mg (0.5 ml) dinoprost tromethamine; treatment 4 (T4; n = 7), 1.25 mg (0.25 ml) dinoprost tromethamine. Ovulations and echotexture of the uterus were determined by palpation per rectum and transrectal ultrasonography. Blood samples were collected and were assayed for determination of concentrations of plasma progesterone. Data was analyzed by one-way ANOVA and differences between the control group and PGF2α treatment levels were subsequently compared using the Dunn’s method (SigmaStat for Windows version 2.03, SPSS Inc., Chicago, IL).
**Accomplishments/Results:**

- All treatment doses with PGF2α successfully induced luteolysis, as evidenced by analyses of concentrations of plasma progesterone by RIA.
- The treatment to complete luteolysis interval (plasma progesterone < 1.0 ng/ml) was significantly shorter for diestrous mares treated with PGF2α (mean ± SEM = 2.36 ± 0.42 days) than for mares treated with saline solution (mean ± SEM = 4.7 ± 0.2 days; P < 0.05).
- All mares underwent an estrus period following luteolysis.
- Ovulation was detected in every estrus occurring after treatments.
- Concentrations of plasma progesterone were ≥ 3.0 ng/ml in 29 out of 32 cycles two days after detection of ovulation and > 5.0 ng/ml in all cycles 3-5 days after ovulation.
- No differences in rising concentrations of plasma progesterone after ovulation were detected between the control group and PGF2α-treated groups (P > 0.10).

**Benefits to the Equine Industry:**

Doses of PGF2α considerably lower than those recommended by the manufacturer, administered as single undiluted intramuscular injections during mid-diestrus were effective in inducing complete luteolysis and a subsequent estrus and diestrus characterized by normal ovarian dynamics (ovulation and follicular dynamics).

**Acknowledgements:**

We thank the Merck-Merial Summer Internship Program, Deborah Resnick, and the NCSU CVM Office for Research for partial funding of this study.
Expression of the sperm protein SP22 in Stallion semen

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Gary Klinefelter
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Charlotte Farin
NCSU Professor of
Animal Science

Description of the Problem:
Identification of a genetic marker indicative of the
fertility of a stallion’s spermatozoa would be an
attractive tool for stallion management. Many of the
events involving the phenomenon of fertilization of an
egg by a spermatozoon are mediated by proteins. One
of these proteins, sperm membrane protein 22 (SP22),
has been localized to the equatorial segment of
spermatozoa in the rat and concentrations of SP22 have
been correlated with the fertility of rat spermatozoa
from the cauda epididymis.
Therefore, genes encoding for these proteins are
potential candidates as fertility markers.

Study Objectives:
Our objectives were to study the pattern of SP22
immunolocalization and semen parameters in stallions
of known fertility during the summer and fall and see if
there was any effect of season on these semen
characteristics.

Experimental Approach:
Semen was collected from four fertile stallions (mixed
light-horse breeds, 7-18 years of age) with the aid of an
artificial vagina (CSU model). Stallions that were not
on a routine collection schedule were collected at least
twice within the week prior to sample collection. A
single ejaculate of semen was collected during the
spring (March 2005), summer (June), fall (September),
winter (December) and spring (March 2006) and
analyzed for basic semen characteristics. For SP22
immunocytochemistry, motile sperm were fixed briefly
and immunostained using a sheep anti-rat recombinant
SP22 primary antibody and FITC-conjugated
secondary antibody.
Accomplishments/Results:
- Percentage of spermatozoa with normal morphology, secondary abnormalities and progressive motility were affected by season (Table 1)
- No differences found in concentration, viability, membrane or acrosome integrity with season (Table 1)
- Percentage of spermatozoa stained over the equatorial segment was affected by season (Graph 1)

Benefits to the Equine Industry:
Utilizing a rat SP22 antibody on stallion spermatozoa could serve as a possible marker of stallion fertility.

Acknowledgements:
We thank Danny Kozink, Drs. Cris Rubio and Anne Schramme for their help with semen collections. We also thank the staff at the NC State Equine Health Center at Southern Pines for technical assistance. This study was partially funded by the NCSU Equine Health Program.

Table 1. Semen parameters for stallions collected across seasons

<table>
<thead>
<tr>
<th></th>
<th>Spring 05</th>
<th>Summer</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring 06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Morphology (%)</td>
<td>72 ± 3^b</td>
<td>85 ± 3^a</td>
<td>83 ± 3^a</td>
<td>68 ± 4^b</td>
<td>75 ± 3^ab</td>
</tr>
<tr>
<td>Primary Abnormalities (%)</td>
<td>19 ± 3</td>
<td>13 ± 3</td>
<td>14 ± 3</td>
<td>20 ± 3</td>
<td>22 ± 3</td>
</tr>
<tr>
<td>Secondary Abnormalities (%)</td>
<td>8 ± 2^ab</td>
<td>2 ± 2^b</td>
<td>3 ± 2^b</td>
<td>13 ± 3^a</td>
<td>3 ± 2^b</td>
</tr>
<tr>
<td>Progressive Motility (%)</td>
<td>68 ± 2^a</td>
<td>65 ± 2^ab</td>
<td>71 ± 2^a</td>
<td>70 ± 2^a</td>
<td>61 ± 2^b</td>
</tr>
<tr>
<td>Acrosome Integrity (%)</td>
<td>94 ± 2</td>
<td>96 ± 2</td>
<td>95 ± 2</td>
<td>92 ± 2</td>
<td>92 ± 2</td>
</tr>
<tr>
<td>Membrane Integrity (%)</td>
<td>61 ± 4</td>
<td>79 ± 4</td>
<td>67 ± 4</td>
<td>66 ± 5</td>
<td>70 ± 4</td>
</tr>
<tr>
<td>Viability (%)</td>
<td>77 ± 4</td>
<td>82 ± 4</td>
<td>80 ± 4</td>
<td>80 ± 4</td>
<td>85 ± 4</td>
</tr>
<tr>
<td>Total Spermatozoa (x10^9)</td>
<td>13 ± 3</td>
<td>18 ± 3</td>
<td>13 ± 3</td>
<td>12 ± 4</td>
<td>15 ± 3</td>
</tr>
</tbody>
</table>

^abMeans with different superscripts are significantly different (P < 0.05)
Data expressed as least squares means ± SEM

Figure 1. Effect of Season on the Percentage of Spermatozoa Stained at Equatorial Segment
Freezing of stallion semen in cryotube vials

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Research Technician III

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Cristiane Rubio, DVM
Theriogenology Resident

Description of the Problem:

Horse semen is commonly frozen in small (0.5 ml) or large straws (4 or 5 ml). If the semen is frozen in small straws, the need to label the straws, package, freeze and store the frozen straws is time consuming; in addition, multiple straws need to be thawed to compose one breeding dose. While packaging a breeding dose in a large straw (4 or 5 ml) has partially remedied the problem of dealing with multiple straws, storage of these large straws requires special containers and manipulation during thawing procedures.

Study Objectives:

The use of cryotube vials has been successful in human spermatozoa cryopreservation. To the best of our knowledge, a scientific evaluation employing cryotube vials for cryopreservation of stallion spermatozoa versus 0.5 ml straws has not been documented. The main goal of the present study was to evaluate the suitability of successfully cryopreserving stallion spermatozoa packaged in 3.6 ml cryotube vials. We hypothesized that the post-thaw semen quality would be similar to that of semen cryopreserved in 0.5 ml straws.

Experimental Approach:

Ejaculates \( n = 16 \) from stallions \( n = 3 \) of known breeding soundness were obtained and processed for freezing. Semen was frozen in 3.6 ml cryotube vials and 0.5 ml plastic straws, which were loaded with 3 ml and 0.5 ml of semen, respectively. The samples were placed in a programmable freezer using a conventional semen-freezing curve. After a minimum of 24 hours of storage in liquid nitrogen, the 0.5 ml straws and 3.6 cryotube vials in were immersed into a 37 °C water bath for 30 seconds and 10 minutes, respectively. Immediately after warming, thawed semen samples were assessed for post-thaw quality (sperm motility and membrane integrity).
Accomplishments/Results:

Mean post-thaw percentage of total motile spermatozoa for 0.5 ml straws and cryotube vials was 46.67 and 38.00, respectively (P < 0.05). Mean post-thaw percentage of progressively motile spermatozoa for 0.5 ml straws and cryotube vials were 39.33 and 31.67, respectively (P < 0.05). However, there was no significant difference between the percentages of intact membrane of spermatozoa packaged in 0.5 ml straws (52.07%) and that of spermatozoa packaged in cryotube vials (45.43%; P > 0.10).

Benefits to the Equine Industry:

The utilization of cryotube vials offers an attractive alternative to package and freeze horse semen. Handling of vials is easy, fast and optimizes storage capacity of standard canes and ultimately, liquid nitrogen tanks. Post-thaw quality of semen frozen in cryotube vials is acceptable and allows one standard breeding dose to be packaged per vial. Adjustments in the freezing curve of programmable freezers to improve post-thaw survival of semen in cryotube vials is currently underway.

Acknowledgements:

We thank Drs. Whitacre and Schramme, and the staff at the Equine Health Center at Southern Pines staff for technical assistance.

Publications:

Sports Medicine

Abstracts:

Schramme M, Little D, Linder K, Pease T. Characterization of a new surgical model of tendonitis of the superficial digital flexor tendon in horses

Mansmann, R, Donoho, S. The Normal Equine Foot based on a Preventive Foot Care Program: A Retrospective Study Involving 108 horses.


Schramme M, Little D, Pease T, Linder K, Redding R. MRI, ultrasound and histological characterization of the equine hindlimb suspensory ligament
Characterization of a new surgical model of tendonitis of the superficial digital flexor tendon in horses

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Associate Professor of Equine Surgery

Dianne Little BVSc PhD MRCVS DipACVS
Postdoctoral Fellow, Equine Orthopedics

Keith Linder DVM PhD Dip ACVP
Assistant Professor Pathology

Tony Pease DVM MS Dip ACVR
Assistant Professor Radiology

Funded by a College of Veterinary Medicine Veterinary Practice Plan Grant

Description of the Problem:

Equine tendonitis is a common devastating injury in horses. Although the collagenase model of tendonitis has been used for many years to study the effect of different treatment modalities on the rate and quality of tendon healing in horses, this model is dissimilar to naturally-occurring tendonitis. As a result, extrinsic healing factors from the peritendinous connective tissues contribute to cellular infiltration and neovascularisation of the lesion, rather than just intrinsic healing factors arising from the tendon’s own cell population and blood supply, as is more likely to happen in naturally occurring disease. Furthermore, treatment of SDF tendonitis may rely on accurate delivery and containment of the therapeutic agent into the tendon’s core. As an example, the differentiation of therapeutically delivered mesenchymal stem cells into tenocytes is likely to be mediated by their location within the tendon’s core, where the appropriate mechanical (tensional forces) and biochemical (growth factors) environment exists for optimal differentiation. It is therefore important that the MSCs can be placed in a contained ‘lesion receptacle’ where they can be expected to stay and be subjected to this local differentiating environment. Naturally occurring tendonitis typically presents with such a centrally located core lesion that forms a perfect receptacle for the therapeutic MSCs. The proposed model of tendonitis is a modification of surgical window models in laboratory animals that have used variable amounts of tendon transaction.
Study Objectives:

1. to create a core lesion within the central third of the metacarpal region of the SDFT
2. to monitor the clinical progression of pain, lameness, swelling and tenderness
3. to monitor ultrasonographically the size of the SDFT, the size and the echogenicity of the core lesion and the fiber alignment in the core lesion
4. to monitor the MR signal characteristics of the core lesion and the parent SDFT with MRI
5. to evaluate and grade the structural characteristics of the tissue contained within the core lesion with histology
6. to compare the ultrasonographic characteristics and the MRI findings with each other and with histological observations

Experimental Approach:

Four horses of 3-6 years of age were recruited for the study and a core lesion was created in the SDF tendon of each front limb. The legs were assessed qualitatively for heat, lameness and pain on palpation of the tendon each day for the first week and thereafter once a week for the remainder of the study. The core lesion in each SDF tendon were monitored ultrasonographically at 1, 2, 4, 6, 8 and 12 weeks after injury. The core lesion in each SDF tendon was also monitored with high-field MRI (Siemens Symphony 1.5 Tesla) at 2, 4, 8 and 12 weeks after injury in transverse, dorsal and sagittal planes. 2D and 3D T1-weighted and T2 weighted sequences with and without fat saturation and a 2D short tau inversion recovery (STIR) sequence were used. Tendon segments were embedded in paraffin, sectioned to 6 micron sections on a rotary microtome and stained with haematoxylin and eosin and Masson trichrome. Sections are being evaluated under plain and polarized light. Levels of the tendon with homogenous histological abnormality were chosen for correlation with imaging studies.

Accomplishments/Results:

- Preliminary data show that a consistent, mild to moderate core lesion can be created using this technique followed by one week of lunging exercise. Horses were not lame at walk at any stage of the study and tendon swelling or pain on palpation were minimal. The maximum size of core lesions ranged from 19 to 24% of the cross sectional area of the tendon and was reached between 4 and 6 weeks of initiation of the lesion. The maximum length of the lesion ranged from 8 to 12 cm on ultrasonographic examination and from 12 to 13 cm on MRI. Histological data are still being analysed.
**Benefits to the Equine Industry:**

Use of this model will make application and investigation of novel intra-tendinous therapies such as stem cell injection easier, by reducing the amount of concurrent peritendinous reaction and allowing for better comparison, so that ultimately stem cell therapies can be tailored properly to the specific demands of equine tendonitis. Improved monitoring of tendon integrity with MRI will enable veterinarians to identify horses at risk of injury better at an earlier stage of the disease and patients with a high risk of re-injury better during the late stages of convalescence.

![Figure 1. Ultrasonographic image of the core lesion at 19 cm distal to the ACB, 4 weeks after lesion induction](image1)

![Figure 2. MR images (Sagittal 2D T1 SE and transverse 3D T1 FLASH) of the core lesion at 19 cm distal to the ACB, 4 weeks after lesion induction](image2)
The Normal Equine Foot based on a Preventive Foot Care Program: A Retrospective Study Involving 108 horses

Richard A. Mansmann, VMD PhD
Clinical Professor
Director of Podiatry and Rehabilitation Services

Shannon “Boo” Donoho
DVM student, class of 2008

Description of the Problem

Foot problems are a primary cause for loss of use and lameness in the horse. With so many different hoof conformations that are seen in many horses, is there a normal or healthy horse hoof conformation? The goal would be to see if some form of normal range of measurements of horses’ feet could be determined based on consistently taken lateral radiographs and hoof measurements. The radiograph would allow for comparison of the position of the hoof and internal bones in relationship to the shoes.

Study Objectives

- To see how measurements of horses’ feet in Central North Carolina compare to what has been suggested generally by observations in the literature.
- No study looking at a large number of horses has been accomplished to develop ranges of measurements for normal horses. This is a preliminary study but more data needs to be collected in different breeds, quality of athletes, and different geographic areas of the country.

Experimental Approach:

Review and measure several areas on the hoof and from lateral radiographs including: the anterior wall thickness, the sole thickness, the sole plane angle (palmar angle), the widest part of the hoof, hoof angle, break-over of the shoe/foot in relation to the tip of P-3, the coronet to proximal extensor process measurement, and the position of the shoe in relationship to the center of the coffin joint. The front feet were examined for 108 horses that were being ridden in low level exercise programs.
Accomplishments/Results:

In general, Thoroughbreds were found to have the lowest palmar angles (1.25º) and the thinnest sole depth (13.00mm). Arabians and Saddle type horses were found to have the highest palmar angles (3.78º) and the thickest soles (17.06mm). Quarter horses had measurements between these two breed categories. The largest disparity in measurements from previous reported observations in this study was with the break-over.

Table 1: Average measurements identified throughout the study

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Average from Study</th>
<th>Current Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Condition Score</td>
<td>6.6</td>
<td>5-6</td>
</tr>
<tr>
<td>Palmar angle</td>
<td>2.35º</td>
<td>3-5º</td>
</tr>
<tr>
<td>Sole depth</td>
<td>13.97mm</td>
<td>&gt;15mm</td>
</tr>
<tr>
<td>Coronet depth to extensor process</td>
<td>14.54mm</td>
<td>15mm</td>
</tr>
<tr>
<td>Anterior wall thickness</td>
<td>20 / 18.88mm</td>
<td>18-20 / 18-20mm</td>
</tr>
<tr>
<td>Toe to heel ration</td>
<td>59% / 41%</td>
<td>50% / 50%</td>
</tr>
<tr>
<td>Break-over in front of P-3</td>
<td>24.6mm</td>
<td>4-7mm</td>
</tr>
<tr>
<td>Hoof angles</td>
<td>53.96º</td>
<td>50-55º</td>
</tr>
</tbody>
</table>

Table 2: Mismatched feet evaluation

<table>
<thead>
<tr>
<th>Hoof angle differences from each foot</th>
<th>0.0 – 1.9º</th>
<th>2.0 – 3.9º</th>
<th>4.0 – 5.9º</th>
<th>+ 6.0º</th>
</tr>
</thead>
<tbody>
<tr>
<td># of horses (%)</td>
<td>68 (63%)</td>
<td>24 (22%)</td>
<td>12 (12%)</td>
<td>3 (3%)</td>
</tr>
</tbody>
</table>

Table 3: Hoof width evaluation

<table>
<thead>
<tr>
<th>Hoof width differences (mm)</th>
<th>0.0 – 4.9</th>
<th>5.0 – 9.9</th>
<th>10.0 – 14.9</th>
<th>+15</th>
</tr>
</thead>
<tbody>
<tr>
<td># of horses (%)</td>
<td>84 (77%)</td>
<td>20 (19%)</td>
<td>4 (4%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Benefits to the Equine Industry:

The more data that can be collected about what is normal or expected in healthy horses feet, the more understanding the industry will have to help prevent hoof conformational problems, treat lameness from hoof conformational problems, use shoeing to enhance limb bone and soft tissue injury healing, and maybe even modify breeding programs.
Regenerating equine tendon using autologous, bone marrow-derived mesenchymal stem cells.

Description of the Problem:

Superficial digital flexor tendon injuries contribute a major proportion of lameness in racehorses and other performance horses, having an incidence of 7-43% in Thoroughbred racehorses. Regardless of treatment, the severity of the injury is the most important prognostic indicator, resulting in return to performance of only 20-71% affected horses, and re-injury is common. During repair of damaged SDF tendon but also of damaged ligaments, normal parallel elastic tendon or ligament fibers are replaced by dysfunctional, stiffer, disorganized fibrous tissue with inferior biomechanical properties, which is considered the reason for the high incidence of loss of performance and re-injury. Recently however, promising results have been obtained with direct injection of cultured bone marrow-derived mesenchymal stem cells (MSCs) into damaged tendons and ligaments.

Study Objectives:

- Evaluate the clinical, ultrasonographic, MRI, histological and mechanical response of the SDFT to bone marrow derived mesenchymal stem cell implantation into surgically induced core lesions

Experimental Approach:

Tendonitis was surgically induced in both forelimbs of 6 horses. Bone marrow was from all horses. Mesenchymal stem cells were isolated, expanded in the laboratory using established techniques, resuspended in bone marrow supernatant, and implanted into the damaged tendon of both legs under ultrasound guidance. Control limbs received sham injection of bone marrow supernatant as treatment. All horses will be euthanased at 12 weeks after
treatment and tendons recovered for histological, biological and biomechanical analysis.

**Accomplishments/Results:**

- We have successfully grown and implanted bone marrow derived mesenchymal stem cells into horses with experimentally created tendon lesions. Data await analysis.

**Benefits to the Equine Industry:**

Anecdotal information suggests that injection of MSCs may offer new perspectives in the restoration of health to injured ligaments and tendons in horses. This exciting new technique deserves further scientific assessment. Once we have determined whether MSC implantation does indeed induce regeneration of normal tendon matrix in our controlled injury model, clinical cases can be recruited on a larger scale for a scientific evidence-based clinical trial to determine efficacy in the clinical arena. Subsequently MSC implantation may become more universally used for optimal repair of injured ligaments and tendons in horses.

![image](image1.png)

Figure 1. Bone-marrow derived equine mesenchymal stem cells in early culture during expansion.
MRI, ultrasound and histological characterization of the equine hindlimb suspensory ligament

**Description of the Problem:**

MRI is a cross-sectional imaging modality that can produce digital imaging slices in any plane, as thin as 1.5 mm, of body regions that can be positioned in or close to the isocentre of the magnet. MRI results in superior anatomical detail and soft tissue contrast and provides information on the fluid and mineral content of bone and is thus ideally suited for imaging of ligaments and tendons.

The normal suspensory ligament contains variable amounts of muscle and ligament. Therefore both ultrasonographic and MRI evaluation of the suspensory ligament is complicated because even a normal ligament with have a very heterogeneous appearance; determining the exact site and extent of the lesion can at times be challenging, particularly if the lesion is small or in an area of the suspensory ligament where a large amount of muscle normally exists. Therefore careful comparison between histological sections of the suspensory ligament and MRI and ultrasound images needs to be made in order to improve diagnosis of suspensory ligament disease.

**Study Objectives:**

Determine if MRI is superior to ultrasonographic examination of the normal suspensory ligament, and in detection of subclinical desmitis of the suspensory ligament.

**Experimental Approach:**

20 horses scheduled for euthanasia for reasons unrelated to hind limb lameness were subjected to lameness examination to determine if they had clinical signs of suspensory ligament desmitis. Both hindlimbs were subjected to ultrasonographic examination. After
euthanasia, hind limbs were harvested and frozen. MRI examination of both hind limbs will be performed, then the suspensory ligament will be dissected and subjected to histological evaluation. Comparison will be made between histological, ultrasonographic and MRI findings so that sensitivity of diagnosis of suspensory ligament disease may be made.

Accomplishments:

The preliminary part of the study has been completed; MRI and histological evaluation of the limbs will start shortly.

Benefits to the horse industry:

MRI has the potential to significantly improve our ability to diagnose suspensory ligament desmitis because of its superior soft tissue imaging capability compared to ultrasonography. It is essential however to validate this technique in normal ligaments, and to determine if some apparently normal variation within the suspensory ligament may be previously unidentified subclinical injury. We expect that earlier and more accurate diagnosis of suspensory ligament desmitis using MRI will improve prognosis and reduce re-injury in horses with this disease.
Medicine and Pharmacology

Abstracts:

Jones S, Eckert R, Neuder L, Trujillo J, Bell J. Targeting p38 to treat equine endotoxemia

Jones S, Eckert R. Targeting p38 to treat inflammation in horses

Proposed role for p38 in regulating LPS induced COX-2 expression in equine leukocytes
Targeting p38 to treat equine endotoxemia

Description of the Problem:
Endotoxemia is a major cause of death in horses with intestinal diseases. The pathophysiology of endotoxemia results from triggering a systemic inflammatory cascade that starts with the expression of a number of pro-inflammatory genes in leukocytes. The Objective of this project was to determine whether the signaling molecule p38 is important for endotoxin-induced gene expression.

Study Objectives:
- Determine whether endotoxin activates leukocyte p38
- Determine whether p38 inhibitors block the ability of endotoxin to increase inflammatory gene expression in equine leukocytes

Experimental Approach:
We determined the effect of endotoxin stimulation on p38 activation associated phosphorylation in equine leukocytes by Western blot analysis. We then determined the effect of treatment with two p38 inhibitors on leukocyte TNFα, IL-8, IL-1β, and COX-2 mRNA levels using real time PCR and protein levels by Western blot analysis and ELISA.

Accomplishments/Results:
- Endotoxin robustly activated leukocyte p38
- Inhibition of p38 abolished the ability of endotoxin to increase TNFα, IL-8, and COX-2 expression.

Benefits to the Equine Industry:
P38 inhibitors may be an effective treatment of endotoxemia in horses.
Targeting p38 to treat inflammation in horses

Description of the Problem:

Neutrophils rapidly migrate into inflamed tissues where they cause cellular injury that accounts for much of the tissue damage in inflammatory diseases. We propose that targeting neutrophil migration is a potential strategy to treat inflammation. The Objective of this project was to determine whether the signaling molecule p38 has a role in neutrophil migration.

Study Objectives:

- Determine whether neutrophil chemoattractants activate equine neutrophil p38
- Determine whether p38 inhibitors block equine neutrophil migration in response to chemoattractants.

Experimental Approach:

We determined the effect of LTB4 and PAF stimulation on p38 activation associated phosphorylation in isolated equine neutrophils by Western blot analysis. We then determined the effect of treatment with a p38 inhibitor on neutrophil migration induced by LTB4 or PAF stimulation.

Accomplishments/Results:

- LTB4 and PAF activated leukocyte p38
- Inhibition of p38 abolished the ability of LTB4 and PAF to stimulate equine neutrophil migration.

Benefits to the Equine Industry:

P38 inhibitors may be an effective treatment of inflammation in horses.