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One-Of-A-Kind Equine MRI Center Opens

The Gail Holmes Equine Orthopaedic Research Center has now added the first equine-dedicated high field strength Equine Magnetic Resonance Imaging Center in the United States to its complex. The Walton Family Foundation, with the support of Ms. Alice L. Walton, donated \$500,000 for the construction of the building that houses the MRI. An additional \$500,000 grant was also donated by Ken Atkinson (now deceased, see memorial on page 7) and his wife Virginia to actually purchase the MRI unit.

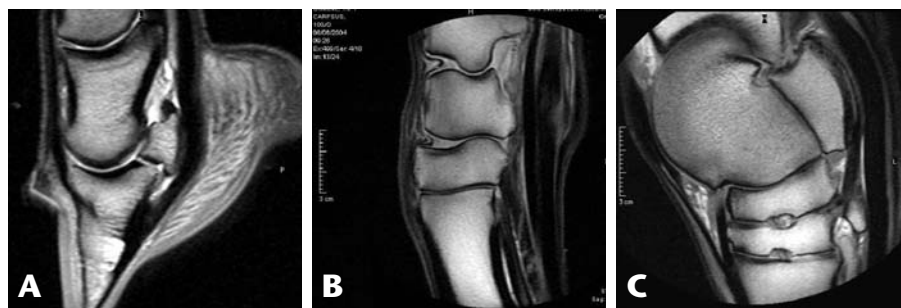
Magnetic resonance imaging is the method of choice for assessing the joint tissues and injuries due to its non-invasiveness and the quality of the images produced. The MRI will be used at the EORC for both



Equine patient under general anesthesia for MRI examination of the right front fetlock.

research projects focusing on osteoarthritis and cartilage repair, as well as diagnosing clinical cases. Using magnetic resonance images, researchers at the university can

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Images of a normal (A) foot, (B) carpus (knee) and (C) tarsus (hock). Both soft tissue structures and bone can be evaluated using MRI. Soft tissue structures such as tendons, ligaments, and synovial membranes can be identified. Cortical bone can be differentiated from bone marrow. On these images cortical bone, tendons, and ligaments are black. Fat in the bone marrow is light gray. Synovial fluid is light gray to white. The ability to visualize all the joint structures significantly improves identification of injuries. Furthermore, MRI provides information about the type of injury that is present. Injuries or abnormalities change the shade of gray of the affected tissue making it possible to differentiate abnormal tissue from normal tissue. The resulting shade of gray is used to determine the type of injury the patient has sustained; acute injuries will appear differently than chronic injuries.

Letter from Dr. McIlwraith

We have had another excellent year, both in productivity from the research center and financial support of the program. One of the highlights this year was the opening of our new Equine MRI Center, which was built between the Gail Holmes Equine Orthopaedic Research Center and the Orthopaedic Research Laboratory. We also hired Dr. Natasha Werpy to run the MRI center; it has already received active use for both referred clinical cases, as well as research.

We have had a number of personnel additions to our research team including Dr. John Kisiday as an Assistant Professor, Sheila Pelkey and Shenna Washington as Research Associates, and Michelle Lee and Barbara Jehu as Assistant to the Director and Receptionist/Administrative Assistant at the Center respectively. A particularly warm welcome for them.

In addition to our continued acquisition of grants and support funding for salaries, we have also gained our second \$3,000,000 endowment, the Iron Rose Endowed Chair in Equine Musculoskeletal Research. We are so grateful to the Iron Rose Ranch for this generous donation, as it will allow us



to fund a critical faculty position in perpetuity.

I would also like to comment on the terrific personnel and great productivity within our center. Our senior investigators have continued to do and supervise excellent research, as well as continue to obtain grant funding. This is no easy feat in these

economic times. We have had two PhD students finish their programs this year, and we wish Dr. Sophie Morisset and Dr. Troy Trumble the best in their future careers. Dr. Marti Shearin and Val Perino are both set up to defend their PhDs this year.

None of this work is possible without the great help of our Research Associates and student hourlies. Heather Colhoun has continued to keep an incredible team together for our surgeries and our horse care. The morale always impresses me when we are working together as we pursue the common goal of making things better for the horse.

A handwritten signature in blue ink that reads "Wayne McIlwraith".

Wayne McIlwraith
Director

Iron Rose University Endowed Chair Enhances EORC's Programs

Iron Rose Ranch donates \$3 million endowment

Thanks to a most generous gift of \$3,000,000 from the Iron Rose Ranch in Carbondale, Colorado, we are pleased to announce the formation of the Iron Rose Endowed University Endowed Chair in Musculoskeletal Equine Disease and Injury. The purpose of the chair is to fund a permanent tenure track position for an excellent researcher focusing on the prevention of injuries in the musculoskeletal system of horses.

The chair will focus on researching the causes of joint disease in horses and humans, as well as effective methods to detect the disease. Specifically, the person appointed to this position will continue the

center's work to isolate mechanisms in joint tissues that induce and further the progression of joint injury and osteoarthritis. The chair will further research methods such as computed tomography, which are layered x-rays of joints; magnetic resonance imaging, (MRI) and joint modeling to develop strategies for early detection as well as to predict joint disease. In addition, the person in the position will be responsible for educating graduate students, undergraduate students and vet students, and will work on clinical orthopedic patients in the veterinary teaching hospital.

"The creation of the Iron Rose Ranch Chair is a great honor for the

College and a lasting tribute to the faculty and staff of the Orthopaedic Research Center, under the leadership of Dr. Wayne McIlwraith," said Dr. Lance Perryman, Dean of the College of Veterinary Medicine and Biomedical Sciences. "We thank the Iron Rose Ranch for its generosity and for its investment in the future of our College and its research, teaching and outreach programs. This gift will greatly help us in our missions of advancing animal care, and curing animal and human disease."

The Colorado State University Foundation permanently invests funds that are given to establish

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Sixth Annual Stallion Auction A Great Success!

The Orthopaedic Research Center and the Equine Reproduction Program at Colorado State University conducted the sixth annual stallion auction in January 2005. Seventy-three (a record number!) donated breedings and a cutting-horse clinic were auctioned online, producing \$194,466 in revenue. The stallions offered in our auction were listed on our website, www.csuequineortho.com, where interested bidders could see photos of the horses, find out details about the stallions, and click on links to the actual auction listings on eBay, the auction website that hosted our catalog of donated breedings.

High Brow Cat, owned by Jack and Susan Waggoner, Weatherford, Texas, brought in a \$35,100 winning bid. The Waggoners have donated



High Brow Cat for the past five years. High Brow Cat is already booked for the 2006 breeding season, but will again be offered in the January 2006 Stallion Auction at CSU for a 2006 breeding. "By our donated breedings, we are able to show our support and appreciation

of the equine research at CSU. The findings resulting from the research has benefited us all. We are pleased to have been able to support CSU in this manner," said Mrs. Waggoner.

All proceeds from the auction benefit these two equine research programs at CSU; proceeds from this stallion auction will help the Orthopaedic Research Center discover better methods for treating and preventing equine musculoskeletal disease and injury and the Equine Reproduction Program improve all areas of equine reproductive health.

To donate a breeding for the January, 2006 auction, or to request to be put on the auction mailing list, please contact Michelle Lee at (970) 297-0386 or by email at michelle.lee@colostate.edu.

Two Orthopaedic Research Center Graduate Students Receive Ph.D. Degrees

Congratulations to Drs. Sophie Morisset and Troy Trumble, both graduate students at the Research Center who received their Ph.D. degrees in 2003 and 2004.

Dr. Sophie Morisset is now an Assistant Professor in Large Animal Surgery at the Veterinary School in Saint-Hyacinthe, in addition to doing surgery and teaching, she plans to continue her research work. Her Ph.D. work at CSU was in combined gene therapy for promoting cartilage healing, and she recently was invited to present this information as a podium presentation at the prestigious Orthopaedic Research Society meeting.

Dr. Troy Trumble has taken an Assistant Professor position at the



Dr. Sophie Morisset

University of Florida Veterinary School as an Equine Surgeon. His Ph.D. was on the effect of metalloproteinase inhibitor in osteoarthritis in the dog. Between completing his Ph.D. and going to Florida, Dr. Trumble worked with



Dr. Troy Trumble

Dr. Simon Turner in his small ruminant comparative orthopaedic laboratory and will be actively pursuing further research at Florida as well as in collaboration at Colorado State University.

Shockwave Therapy: Effective Osteoarthritis Relief

The Orthopaedic Research Center recently completed a study to examine the effectiveness of shockwave therapy as a treatment of joint disease, led by Dr. David Frisbie. The research group found that shockwave therapy was more effective than Adequan®, a commonly used intramuscular injection of glycosaminoglycans for reducing lameness in arthritic horses.

What is Shockwave Therapy?

Extracorporeal shockwave therapy (ESWT) uses pressure waves generated by a shockwave machine, directed to the injured area by a probe similar to an ultrasound probe. The shockwaves are generated electrohydraulically by using a high voltage spark gap in a fluid filled reflector. When a spark is created, some of the fluid is vaporized, which creates a pressure wave through the surrounding fluid within the probe. That pressure wave is then transmitted as focused energy that targets the specific site of injury. An unfocused shockwave would be the supersonic boom that occurs when airplanes break the speed of sound.

The Shockwave Study.

A group of horses with similar levels of carpal arthritis were tested in this study. The horses were divided into three treatment groups: sham control, positive control, and shockwave treated. The sham control group had bubble wrap applied to the probe to absorb the energy from the shockwaves, but were treated similar to the shockwave-treated group. The positive control group received an intramuscular injection of Adequan®, a polysulfated glycosaminoglycan pharmaceutical manufactured by Luitpold Pharmaceuticals Inc.,

every four days for twenty-eight days. The shockwave-treated group received ESWT on days 14 and 28 using a VersaTron® shock wave machine manufactured by High Medical Technologies. The horses started a rigorous exercise schedule five days a week for the remaining eight weeks of the study. Synovial fluid and blood serum samples were taken every other week, and the horses had lameness evaluations performed every two weeks using the AAEP grading scale. At the end of the study, the operated joints were evaluated biochemically and histologically.

there was no improvement seen with either the ESWT or the Adequan® treated horses. It is expected that intraarticular Adequan® would be more potent due to the localized delivery. Synovial fluid total protein, a parameter of synovitis, was significantly reduced, suggesting a possible mechanism for the treatment effect of shockwave therapy; ESWT appears to affect the soft tissue around the joints, leading to decreased pain and lameness, while improving the “environment” in the joint. During the short duration of this study, a decrease in the progression of arthritis



Dr. David Frisbie administers a shockwave treatment.

The Results

Shockwave therapy was found more effective than Adequan® for reducing lameness in arthritic horses. Significant improvement in clinical lameness was recorded at the first evaluation after treatment, as well as all subsequent evaluation periods in the ESWT horses. Histologically,

was not observed; therefore this type of treatment would be best considered in combination with a chondroprotective agent. Please contact your veterinarian to discuss your options if you think your horse may benefit from shockwave therapy.

Studies on Racetrack Surfaces and Their Variability

Introduction

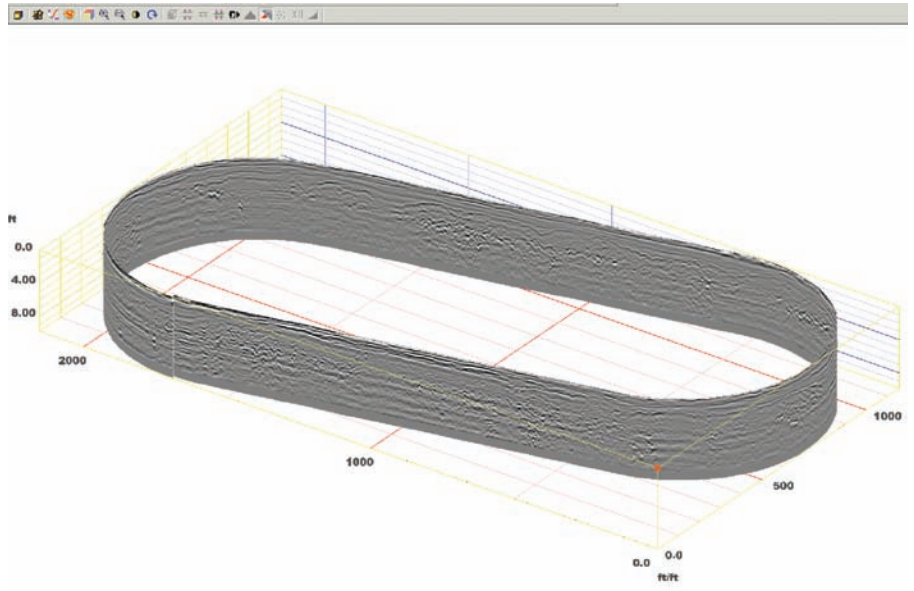
Lameness and injury at the racetrack is a serious problem for the welfare of the equine athlete and the equine racing industry, as well as the economics of the racing business. The injuries can be due to a number of factors, one of them being variability in racetrack surfaces. A collaborative study is underway between Dr. Wayne McIlwraith, Director of the Orthopaedic Research Center, Dr. Raoul Reiser of Human Sports Sciences at CSU, and Dr. Mick Peterson, Mechanical Engineering at the University of Maine. The team has been working with cooperating California racetracks to understanding variability in track surfaces. The hope is that understanding how the surfaces vary will help them learn how to reduce the inconsistencies in order to reduce racing injuries.

Funding

The initial stage of this study was started with a \$70,000 start-up grant from American Quarter Horse Association (AQHA). During the summer of 2004, further development and testing of California racetracks was funded by Thoroughbred Owners of California. The current stage is being funded by an additional \$60,000 from the Oak Tree Foundation and Southern California Equine Foundation.

Biomechanics

Kinematic studies were done at Santa Anita Raceway as well as using the treadmill at Colorado State University by filming a running horse at 500 frames per second (typical filming is 30 frames per second) to fully understand the mechanics of hoof impact.



An example of ground penetrating radar data obtained from the harness racing track in New Hampshire

The Test Apparatus

Based on preliminary work by Dr. Reiser, a test machine was built by Dr. Peterson to mechanically replicate hoof strike on a track with similar acceleration, speeds, and loads as a racehorse. The mechanical hoof replicates the initial impact of

the hoof on the racetrack which includes a strike and in a properly designed track, a small slide associated with deceleration of the hoof. This motion is replicated with a simulated hoof cast out of a hard rubber material. The large apparatus

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Geophysical Survey Systems ground penetrating radar test of a harness racing track in New Hampshire.

Update on the Global Equine Research Alliance Study

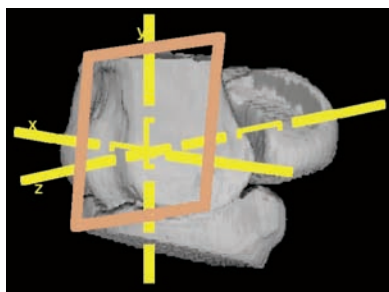
Recent results from the collaborative study between researchers at CSU, Massey University in New Zealand, Utrecht University in The Netherlands and The University of London have shown beneficial effects of early training on bone. As reported previously in this newsletter, the investigators are studying a group of 33 Thoroughbred horses in New Zealand. Half of these horses have been exercised since 10 days of age, in addition to the normal pasture routine of the control group. Several clinical and imaging examinations have been performed to date, in particular computed tomographic (CT) imaging of the fetlock and carpal joints. The objective of this portion of the study was to evaluate the effects of early exercise on the density pattern of subchondral bone

in the fetlock joint at 18 months of age. The fetlock joints were CT scanned and the images were imported into a software package that created a 3-dimensional model of the joint, preventing the need to physically remove the bone. The computer image was then manipulated so that the area of interest could be analyzed. Once the digital slices were obtained, a density map was superimposed on the slices to identify density patterns that might predispose the horse to injury. In this case, we were interested in the palmar aspect of the cannon bone in the fetlock joint as this is where osteoarthritis and condylar fractures begin. The hope was to be able to identify changes in this area due to the early exercise.

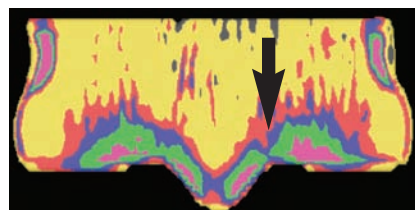
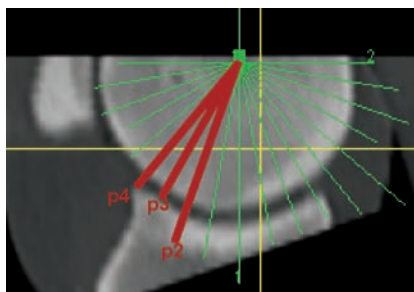
In this study we found that early exercise had a significant effect on certain parameters of bone density, such as average bone density. However, we found that the pattern of bone density did not differ between groups. We are currently exploring the effect of certain density patterns on subchondral bone of the third metacarpal condyle, and we feel that there is a pattern that might predispose some horses to fracture. In this study, that pattern was found in both exercised and control horses; therefore, factors other than exercise might exist that would induce this density pattern, warranting further investigation.

Acknowledgements: *Our share of the costs for this three-year project comes from the Marilyn Simpson Family Trust.*

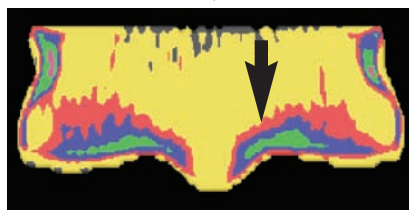
3-D joint model from CT scans



Area of interest is outlined and the slice is made



A slice showing low bone density in the area where condylar fractures occur



A slice showing a normal density gradient

Iron Rose University Endowed Chair Enhances EORC's Programs

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endowed chairs, and the interest generated is used to support the chair. Since the principle amount is not used, endowments allow continuous funding to supplement the chair holder's salary, graduate student work, research and activities that are tied to targeted industries. The \$3 million gift for the Iron Rose Ranch Chair is among the largest gifts Colorado State University has received to establish a chair, and is the second University Endowed Chair at the Orthopaedic Research Center.

Orthopaedic
Research Center:
www.csuequineortho.com

A Memorial to Kenneth E. Atkinson

It is with great sadness that we report the death of Mr. Kenneth E. Atkinson in early September 2004. Mr. Atkinson was a great personal friend and a fantastic friend of CSU's equine research programs. He had served on the CSU Equine Orthopaedic Research Advisory Board since its inception. He and his wife Virginia had donated a total of \$2,000,000 to the Equine Sciences program at CSU and more recently had given the EORC \$500,000 for the purchase of a high field strength MRI (see cover page).

Ken was a wonderful man who became a great friend of CSU through the love of his horses. "Bill Pickett [CSU's first Director of Equine Sciences, now retired] introduced me to Ken about twelve years ago when I first looked at Socks"



Ken Atkinson and "Socks"

reminisced Dr. McIlwraith. Ken's favorite horse Socks, had been attended to by Dr. McIlwraith and staff at the EORC on many occasions. At the age of 21 (and only a few months before Ken died), Socks had to be euthanized because of

chronic arthritic problems. Remembering the horse with great fondness, Dr. McIlwraith recalls "We had managed to keep him going for about twelve years with various ailments. His temperament was fantastic, reflecting his owner's."

Studies of Racetrack Surfaces and Their Variability

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is attached to the rear of a vehicle and can be moved around the track to test the performance of the surface at various points around the track.

Preliminary Results

Over the Summer and Fall of 2004, six tracks were tested using a standard test protocol. Multiple tests were performed at each of the 1/8 poles after racing were finished for the day. Tests were also performed throughout the course of the day at a single location to assess the variability of the track over the course of the day. The mechanical hoof system automatically acquired data that simultaneously measures shear strength and harness of the soil.

While results are in many ways preliminary, some trends have

become quite clear from the testing over the summer of 2004. Most importantly, it appears that the variability within a particular track can be significant. Most of the tracks showed variability from point to point during testing. This variability is either caused by subsurface compaction or inconsistencies in the track base. These results differ from nearly all previous testing results of tracks in that the testing is performed in-situ with the loads and speeds associated with a horse at a gallop. Thus, soil characteristics at depths not considered in previous work have been testing using the mechanical hoof. The variability that has been

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Dr. McIlwraith Earns Honorary Doctorate from University of Turin

Dr. McIlwraith traveled to Italy in May 2004 to receive an honorary doctorate from the University of Turin in recognition of his contributions to veterinary medicine. The ceremony was part of the University of Turin's 600th anniversary celebration. In addition to this degree and a DSc from Purdue University in Indiana, Dr. McIlwraith has two other honorary doctorates; one from the University of Vienna in Austria, and the other from Massey University in New Zealand.

Volunteer Program

The volunteer program is a wonderful asset to the Orthopaedic Research Center. Between 10 - 30 people, most of them pre-veterinary students, volunteer each semester. Since the research projects entail many different activities, volunteering at the Orthopaedic Research Center is a wonderful opportunity for a student to get “hands on” veterinary experience. The volunteers help with handwalking and treadmilling horses, administering treatments, assisting during surgery, working in the lab, grooming and, of course,



dispensing horse treats. The volunteer experience is designed to help prepare students for the veterinary curriculum.

Currently, our volunteers include the following people: Ashley Rosenberg, Desiree



Kirsch, Genna Fishgold, Jessica Holland, Julie Enderby, Katie Olszowy, Leslie Edmonds, Naomi Fiel, Nina Lawler, Phil Kieffer, and Wade Walker.

The Orthopaedic Research Center accepts new volunteers every semester. For more information,



please contact Lindsay Biermann at lbierman@lamar.colostate.edu.

One-Of-A-Kind Equine MRI Center Opens

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more specifically diagnose injuries and illness. Veterinarians use these images to see fluid in bone, which is painful for horses, and see soft tissues, which is not possible with x-rays. They also can make diagnoses using multi-planar imaging, which produce two images in different angles taken from a single image.

“With our new facilities and equipment, we can diagnose injuries we could never diagnose before,”

said Dr. Natasha Werpy, an Assistant Professor in the department of Clinical Sciences at Colorado State who was hired to run the MRI center. (See New Personnel, page 9) “We plan on sharing the results of our research to enhance the diagnosis of injury and develop improved treatment.”

“Using both research and equine clinical patient studies, we will be able to discover new ways to

advance early diagnosis of bone and joint disease, better methods of treatment and a better understanding of how exercise-induced traumatic disease occurs,” said Dr. Wayne McIlwraith, director of the Orthopaedic Research Center. “The focus of our program is preventing or minimizing osteoarthritis in horses, and diagnosis of conditions that lead to osteoarthritis using MRI will greatly facilitate this goal.”

Orthopaedic Research Center: www.csuequineortho.com

New Personnel

Dr. John Kisiday



Dr. John Kisiday was hired as an Assistant Professor in Clinical Sciences in a research

and teaching appointment at the ORC in January 2005 after doing his PhD at MIT in Bioengineering and a collaborative post-doctorate with CSU and MIT. His doctorate work primarily focused on mechanobiology, the study of the impact of physical deformation on cells, and the use of a novel peptide-based material (discovered at MIT in the early 1990's), as a three-dimensional scaffold for cartilage tissue repair. Dr. Kisiday's post-doctorate work explored chondrogenesis of equine stem cells for potential applications to equine and human therapies. The research Dr. Kisiday will focus on at the ORC will involve cartilage tissue engineering therapies and mechanobiology in order to build the bridge between basic laboratory studies and beneficial animal models.

Dr. Natasha Werpy



Dr. Natasha Werpy joined the EORC as an Assistant Professor in June 2004 in a 50% faculty position to run the new

MRI center. Previously, she worked for the EORC part-time while doing a non-traditional radiology residency, split between CSU and Dr.

Norman Rantanen in California. Her DVM degree is from Colorado State University. Dr. Werpy enjoys riding her two horses, one of which is a rescue horse, and plans to show her jumper horse again soon.

Michelle Lee



Michelle was hired part-time in November, 2004 to assist Dr. McIlwraith at the

EORC, where she will coordinate the stallion auctions and edit the annual newsletter and bi-annual lab report, among other fundraising activities. Michelle was a high school chemistry teacher for twelve years in New York and Maine before coming to Colorado for her husband's new career opportunity. She has two children, Aidan, 7, and Anna, 4, who are into hockey and figure skating, respectively. Michelle has an Animal Science B.S. from Cornell University in 1989, and a M.S. in Science Education from Syracuse University in 1990.

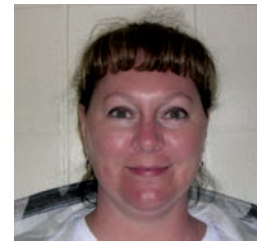
Barbara Jehu



Barbara Jehu joined the EORC team in November, 2004, as the department receptionist.

Although she is new to the EORC, she has previously worked for CSU for three years in network services. As a long-time native of Hawaii, living in Colorado and working with horses is quite exciting. She and her husband have two Quarter horses trained for police work.

Sheila C. Pelkey



Originally from Cornwall, NY, Sheila moved to Colorado in 1990, where she

graduated from Bel-Rea Institute of Animal Technology in 1997, and worked in a mixed animal practice in Parker, Colorado. Sheila started working at CSU in 1998 as a Large Animal Emergency Technician. After moving to the food animal department for 5 years, she came to EORC in November of 2004. Sheila has ridden and worked with horses since she was 6 years old. At the EORC, she assists with anesthesia on the research and client MRI horses as well as helps the doctors with shockwave therapy appointments. Her husband Rick, red heeler puppy and appendix quarter horse keeps her very busy when not at work.

Shenna Washington



Shenna joined the Equine Orthopaedic Research Center as a new

Histology/Pathology Technician in August of 2004. Prior to that, Shenna earned her B.S. in Psychology from Michigan State University, and has approximately six years of laboratory experience. She has been very efficient in providing the EORC with useful histological data. A Michigan native, Shenna was eager to join the EORC team and is fully enjoying her new position and life in Colorado.

Orthopaedic Research Center Supporters – 2004

Platinum Level – \$1,000,000+

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Pro Sports Club

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Bar H Ranche

Dr. Glen Blodgett
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Studies of Racetrack Surfaces and Their Variability

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observed in some cases is as high as 300% difference in peak loads on the hoof. This variability is comparable to treading on asphalt versus grass and while not evident in the typical racing surface, it shows the huge differences that can occur if proper maintenance techniques are not used.

The next stage of the project is to determine the source of the variability. The only way to see what is causing the changes in peak load is to be able to see through the track surface and check the base and evaluate track surface compaction. Thanks to the Oak Tree Foundation and Southern California Equine Foundation the next stage of the project has started. A new ground-penetrating radar system has just been delivered and

is now being calibrated for use in seeing below the surface of race tracks. This is a technology that has been previously used in oil exploration and in roadway evaluation, and based on some pilot tests, is being developed to provide a visual evaluation of the subsurface of the track as well as the compaction.

What Can Be Done

In the past, understanding of track composition was considered to be the key to eliminating the variability in race track surfaces. The organic content, particle size, and moisture content were monitored to ensure that the track would be the same one day as the next. However, this has always been a challenge due to variation in local conditions and has relied on the experience of the track

superintendent to ensure a safe racing surface. Recently, interest has also emerged in synthetic racetrack surfaces which have tremendous potential to reduce the sensitivity of the track to weather conditions. However, the details of track maintenance, whether it is synthetic or natural, are, in general, not a concern to the horsemen or the public. Ultimately what everyone wants is a safe track surface that is fair. The hope of this research is to develop a series of tools that can both ensure that the horse sees a consistent track surface and can assist in the diagnosis of problems if they do occur. Ultimately, it is hoped that we can remove track surfaces from the list of causes of injury, and prolong the career of these incredible athletes.



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Arthros is an annual CSU Orthopaedic Research Center publication.

Our Purpose:

To find solutions to musculoskeletal problems, especially joint injuries and arthritis in horses and humans.

Our Philosophy:

To offer the best treatment of clinical cases possible, with continued and critical assessment of our results; to use these results to change our treatments; to point our research toward prevention of problems we cannot treat effectively or that cause permanent clinical damage.

Our Goals:

To find new methods to heal joints already damaged; to use state of the art research techniques to find ways to prevent the occurrence of joint diseases and musculoskeletal injuries; to find methods of early treatment to prevent permanent damage when joint disease does occur.

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Stonerside Stables

John Andreini

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Bobby Lewis, DVM

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President-elect, American Association
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Elise Lufkin

Quarter Horse owner, Idaho

Robert Lewis

Thoroughbred owner,
Southern California

Richard Mandella

Racing Thoroughbred trainer,
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