



PHILANTHROPISTS JOHN AND LESLIE MALONE LAUNCH NEW INSTITUTE FOR BIOLOGIC TRANSLATIONAL THERAPIES WITH \$42.5M GIFT

Philanthropists John and Leslie Malone, fascinated by the healing power of stem cells, have committed a record \$42.5 million to Colorado State University to develop regenerative medical therapies for animals and people. It is the largest cash gift in University history, a remarkable commitment to improved human and animal health and well-being.

The donation will launch the CSU Institute for Biologic Translational Therapies to investigate next-generation remedies based on living cells and their products, including patient-derived stem cells, to treat musculoskeletal disease and other ailments. Colorado State veterinarians are expert at analyzing and developing medical treatments for animal patients, then providing knowledge gained to boost human medical advancements; the progression is known as translational medicine and is successful because of similarities in animal and human physiology and disease.

“We are tremendously grateful to John and Leslie Malone for their generous philanthropy, foresight, and dedication to scientific discovery,” Colorado State University President Tony Frank said. “In addition to giving the largest cash gift in the University’s history, their commitment positions us to build on our foundation as a leader in translational medicine, where advances in veterinary medicine very rapidly move into the sphere of benefiting human health.”

THE PROGRAM EVOLUTION

The Institute for Biologic Translational Therapies has long been a vision of Drs. Wayne McIlwraith, David Frisbie and Chris Kawcak. As we move forward on this incredible endeavor, it is valuable to reflect on how the Gail Holmes Equine Orthopaedic Research Center started and evolved to this latest project. It began in 1984 with Dr. McIlwraith noting that while arthroscopic surgery had revolutionized our ability to treat equine athletes, there were also certain limitations. The program began doing basic research addressing some of these questions. The re-

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ABOVE, LEFT TO RIGHT:
LESLIE MALONE, DR. WAYNE
MCILWRAITH, JOHN MALONE,
AND DR. MELINDA STORY AT
HARMONY SPORHORSES



ORTHOPAEDIC RESEARCH CENTER

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search program was elevated to a new level when Drs. Kawcak and Frisbie completed their Ph.D.s with Dr. McIlwraith (they had previously completed surgical residencies at CSU) in 1995 and 1996. Dr. McIlwraith was able to keep Drs. Kawcak and Frisbie, thanks to the generosity of the Stavros-Niarchos Foundation (through Maria Niarchos-Gouazé). The Orthopaedic Research Center received a commitment to provide four years' salary and benefits. The research program continued to add other valuable faculty and staff, and the growing team became very productive. Drs. Kawcak and Frisbie have worked closely with Dr. McIlwraith to provide leadership to the research program over the years. The new institute is a culmination of the evolution and is a testament to how far we have come.

The Institute for Biologic Translational Therapies will be unique in its focus on developing regenerative treatments from inception in the laboratory setting, through clinical trials, to commercialization of new technologies.

MALONES' HORSES HELP INSPIRE GIFT

"You put so much training into them, it would be wonderful to have them enjoy their health for a longer period," Leslie Malone said. Blixt, their promising dressage competitor and gelding that suffered lameness, underwent successful arthroscopic surgery at the Colorado State Orthopaedic Research Center, received stem cell injections, and now is back to training.

"We think this whole area of research is very exciting in what it portends for humans and animals," John Malone said. "When you say, 'Who's in the best position to do something about this?' - to take cutting-edge research and apply it pragmatically to the problems we see that people and horses are encountering on a day-to-day basis - it became pretty logical. CSU was the right place to go"

The Malones' gift will provide \$10 million for operations and \$32.5 million for construction of an institute building, to feature laboratories, specialized surgical suites, and conference space for veterinarians and physicians. The lead gift requires \$32.5 million in matching donations for building construction.

GIFT WILL SHAPE FUTURE THERAPEUTICS

The Malones, dedicated to dressage and racehorses, first encountered Colorado State through its Orthopaedic Research Center, led by Dr. McIlwraith, University Distinguished Professor and renowned equine arthroscopic surgeon and orthopaedic researcher.

In 2013, the philanthropic couple donated \$6 million to endow the Leslie A. Malone Presidential Chair in Equine Sports Medicine, a way to foster prevention, diagnosis, and treatment of injuries in performance horses.

They soon focused on the Orthopaedic Research Center's work in biological therapies - with gene therapy, stem cells, specialized tissue replacement, and novel proteins. These therapies, used alone and in combination with minimally invasive surgery, could provide more effective and longer-lasting treatment for equine athletes and people with osteoarthritis and orthopaedic injuries.

"We are so thankful for John and Leslie's support and consider them real partners," Dr. McIlwraith said.

BIOLOGIC THERAPIES ARE THE NEXT HORIZON

John Malone, a dedicated athlete in his school days, described his own orthopaedic aches and pains while explaining the vision he and his wife have for advancing regenerative treatments.

"This is a very exciting and very broad area of research, and it's going to pay big dividends in both human and animal medicine," Malone said. "It seems entirely appropriate to assist in the development of this research at one of the top vet schools in the country"

The institute established with the Malones' lead gift will allow Colorado State to vault ahead in its work.

"We've really gone through a transformation in recent years, with more participation in human medicine," said Dr. McIlwraith. "This has occurred because of the comparability of equine joints and equine joint problems with human joint problems, extending into tendon and ligament injuries, which are big concerns in both humans and horses. This new institute takes us to another level with all of this work." ■





WELCOME TO THE WINTER/SPRING EDITION OF *ARTHROS*. It is really the 2014 issue that is coming to you late. The newsletter highlights some important news, as well as research findings from the past year. Most notable is the \$42.5 million gift from John and Leslie Malone, which is the largest cash gift ever given to Colorado State University and is truly transformational for our Orthopaedic Research Program and will take us to a higher level. There is a separate article on this. We are so grateful to the Malones for their generosity and their passion for what we do. In the last issue of *Arthros*, we reported that they had given us a \$6 million Presidential Chair in Equine Sports Medicine. We have also received a substantial gift from the Barbara Cox Anthony Estate (Barbara Cox Anthony had previously donated a \$3 million endowed Chair that I have the honor of sitting in, as well as a second University Chair in Oncology). The latest gift has funded the reroofing of the Orthopaedic Research Laboratories, which allowed for improvement in those facilities and renovations, as well as other support. We thank Barbara Cox Anthony's son, Jim Kennedy, for his continued support of our program. Another new donor is the Louis L. Borick Foundation, which is allowing us to purchase and house the first standing equine computed tomographic unit (coming in May) in the U.S. I particularly thank Robert Borick for this support.

A number of exciting research projects are summarized here. Particularly notable are collaborative projects with MIT looking at the combination of microfracture and a self-assembling hydrogel to promote the repair of defects in the equine stifle (directly comparable to the human knee) that has been published in the prestigious *Journal of Bone and Joint Surgery*; two very positive studies on the value of intra-articular

MSCs for traumatic injury to the equine femoral tibial joints, as well as a demonstration of enhancement of cartilage repair and development of a new standing CT from Epica™, which is the beginning of an ongoing collaborative project with the company to develop a standing CT for the limb. Further details of our research for the last year will be available in our *2014 Orthopaedic Research Center and Orthopaedic Bioengineering Research Laboratory Report*. If you would like a copy, please contact Kristy Wygmans at the ORC.

Arthros also details new developments in the faculty, staff, and facilities. Our first two graduates from the residency program in Equine Sports Medicine and Rehabilitation, Dr. Dora Ferris and Dr. Erin Contino, both passed the examination and are now Diplomates of the ACVSMR. Dr. Myra Barrett joined us as a faculty member and is the first tenure-track position specifically in equine imaging. Dr. Mindy Story joined us as an assistant professor in Equine Sports Medicine and Rehabilitation and Dr. Erin Contino joined our faculty as an equine fellow in imaging and is going to become an assistant professor in the Equine Sports Medicine and Rehabilitation program later this year. We also saw a number of other staff changes, including Chrissy Battaglia joining us as a research scientist/lab manager. Her contributions have already made a significant change to efficiency within the lab.

Best wishes,

Wayne McIlwraith
Director

ORTHOPAEDIC RESEARCH CENTER HOSTS 5TH INTERNATIONAL CARTILAGE REPAIR SOCIETY LABORATORY SKILLS COURSE FOR TRANSLATIONAL SCIENCE



Above: Participants in the 2014 fifth ICRS Laboratory Skills Course at CSU Gail Holmes Equine Orthopaedic Research Center

ON OCT. 27-29, 2014, THE GAIL HOLMES EQUINE Orthopaedic Research Center hosted the fifth ICRS Laboratory Skills Course for Translational Science “From the Lab to the Clinic.” The workshop was limited to 30 participants and was fully enrolled. In addition to Drs. Wayne McIlwraith and John Kisiday (who were the course leaders), the other faculty were Drs. David Frisbie, Chris Kawcak, Laurie Goodrich and Myra Barrett from Colorado State University, Dr. Stephanie Bryant from the University of Colorado Department of Chemical and Biological Engineering, and Dr. Daniel Grande from the Feinstein Institute for Medical Research, Hofstra North Shore-LIJ School of Medicine. The 30 participants included clinicians, engineers, and biologists from both academia and industry and were from the United States (10), Brazil (6), Netherlands (3), India (2), Greece (2), Peru (2), and one each from New Zealand, Mexico, Canada, Belgium, and Saudi Arabia, reflecting truly international participation. The workshop focused on translation, from the laboratory development of cartilage repair strategies through in vivo testing and analysis. A special emphasis was placed on animal models, which is a longstanding area of expertise for faculty at the Orthopaedic Research Center.

The workshop opened with lectures on the use of small- and large-animal models, practical aspects of creating chondral or osteochondral defects, and methods for characterizing the accumulation of repair tissue at the termination of the study. These presentations were followed by a hands-on laboratory.

The second module focused on the laboratory aspect of creating or testing cartilage repair strategies, including a review of fundamental aspects of isolating and expanding cells, in vitro culturing of cell-seeded constructs, and analysis of extracellular matrix. Within these lectures, the use of hydrogels to deliver cells

to cartilage defects was highlighted. The afternoon laboratory involved two activities: creating concentrated PRP from whole blood, and preparing and casting of fibrin hydrogel into defects that were created previously.

The third module focused on clinical imaging, with lectures covering state-of-the-art technique for imaging cartilage repair tissue in situ using MRI, ultrasound, regular and contrast CT, and radiography. The lectures were followed by a discussion of images obtained from completed live animal studies from the Orthopaedic Research Center.

ICRS Skills Courses are educational courses that expand knowledge and laboratory skills in advanced techniques for cartilage repair and teach how to translate findings through clinical testing and analysis. ■



Above: Participants in the 2014 fifth ICRS Laboratory Skills Course at CSU working in one of the laboratory sessions

COLORADO STATE UNIVERSITY AND EPICA™ MEDICAL INNOVATIONS LAUNCH FIRST-EVER EQUINE-SPECIFIC COMPUTED TOMOGRAPHIC SCANNER

Colorado State University will soon be home to Pegaso™, the world's first-ever CT scanner specifically designed for equine medicine.

Pegaso™ represents a quantum leap in diagnostic, interventional, and intraoperative imaging, and was built from the ground up to fulfill the previously unmet imaging needs of equine veterinarians. Because of the logistics of a horse's size, it has been a constant struggle for equine veterinarians to obtain quality CT images utilizing machines originally designed for human medicine. The new device will allow equine veterinarians to perform a CT scan of a standing horse's head and neck up to the C7 vertebrae and any anatomy of an anesthetized horse, including distal limbs. The fully robotic, high-definition CT scanner also includes large-field, high-resolution fluoroscopy and digital X-ray.

The unit features a resolution that is 1,481 times higher than standard CT. The superior image quality will help practitioners to provide more accurate diagnoses and treatment plans. "The Pegaso™ provides unmatched CT image quality for both soft and hard tissues. It will change our

imaging paradigm for the horse," said Dr. Chris Kawcak DVM., Ph.D., Diplomate ACVS and ACVSMR, professor, Gail Holmes Equine Orthopedic Research Center, College of Veterinary Medicine and Biomedical Sciences, Colorado State University.

Dr. Kawcak is currently working with Epica™ developers to optimize equine imaging with this new device, and to develop a new, smaller unit that can be used to image the limbs of horses without the need for

general anesthesia.

Cone-beam computed tomography is a high-resolution imaging technique that has been used in dental imaging for years. Unlike regular CT, which takes slice-by-slice images through the area over several minutes, CBCT takes a 3-D image of the area in less than 30 seconds, making it ideal for imaging equine limbs. Bone, tendon, and ligament damage can all be diagnosed in less than 30 seconds with far more accuracy than radiographs

or ultrasound. With a single scan, software could be used to manipulate the image to optimize bone detail or tendon and ligament detail. Only one scan would be needed to image all tissues, in contrast to previously used modalities of combining X-ray and ultrasound imaging to obtain a complete picture.

This is part of a larger endeavor at CSU, through the development of the Institute for Biologic Translational Therapies, which was made possible through a \$42.5

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THE UNIT FEATURES A RESOLUTION THAT IS 1,481 TIMES HIGHER THAN STANDARD CT. THE SUPERIOR IMAGE QUALITY WILL HELP PRACTITIONERS TO PROVIDE MORE ACCURATE DIAGNOSES AND TREATMENT PLANS.



Colorado State University will soon be home to Pegaso™, the world's first-ever CT scanner specifically designed for equine medicine.



ARTHROSCOPIC SURGERY COURSES AT CSU IN AUGUST 2014

“JUST A QUICK NOTE TO SAY THANK YOU FOR ALL YOUR HELP WITH REGISTRATION FOR THE EQUINE ARTHROSCOPY COURSE. WHAT A WONDERFUL AND INFORMATIVE COURSE THE THREE DAYS WERE. I HOPE TO ATTEND FURTHER CPD COURSES AT CSU BASED ON LAST WEEK’S EXPERIENCE. MANY THANKS FOR WHAT WAS THE BEST CPD COURSE I HAVE EVER ATTENDED.”

**—Dr. Tony Doherty
M.V.B, MANZCVS, M.B.A.
Queensland, Australia**

Historically, the first course on diagnostic and surgical arthroscopy on the horse was presented at CSU by Dr. Wayne McIlwraith in June 1983, and the first advanced arthroscopic surgery course was taught in 1988, with two days of lectures and laboratories. The most recent basic and advanced courses were held Aug. 21, 22, and 23, 2014, and we remain the center for arthroscopic surgery training both in the U.S. and internationally.

The advanced course this year had a focus different from previous courses and included three laboratories to train participants in internal fixation of intra-articular fractures of the carpus and fetlock, including carpal slab fractures, fractures of the distal metacarpal/metatarsal condyles, proximal phalanx fractures, and sesamoid bone fractures.

The course was supplemented by new material from the Fourth Edition of *Diagnostic and Surgical Arthroscopy in the Horse* by Drs. McIlwraith, Alan Nixon, and Ian Wright. Dr. David Frisbie also contributed a section to the fourth edition on his standing arthroscopy technique, which you can read more about in this edition of the newsletter.

These courses are very well attended and offer a unique experience, allowing participants to interact and gain individualized training in their areas of interest. ■

SCANNER *continued from Page 5*

million gift from John and Leslie Malone. As part of the institute, the imaging center will help to develop new technologies that can be used in both veterinary and human medicine. Current developments at CSU include:

- Dual-energy imaging to characterize bone edema and bruising using CBCT
- Contrast enhancement and dual-energy imaging to characterize tendon and ligament injury
- Contrast enhancement to characterize the metabolic state of articular cartilage, which is an early indicator of joint damage. This biomarker can be used to reverse and prevent the progression of cartilage damage and osteoarthritis in horses and humans.
- Evolving acquisition and reconstruction technology to better optimize image resolution.
- Software algorithms development that use CBCT data to obtain sensitive information about abnormal joint mechanics and shape that can influence the development of lameness in an athlete, and is a sensitive technique to follow joint disease progression over time.
- Collaboration on the development of Spectral CT, which can be used to characterize subtle changes in bone chemistry that can serve as a biomarker of early disease.

These innovations open up a new world of opportunities and ways equine veterinarians can diagnose and treat both horses and humans, ultimately improving prognoses and outcomes.

Funding for this acquisition was principally gained from the Louis L. Borick Foundation through Robert Borick, and the CT imaging center will be named after this foundation. ■

REDEFINING INTEGRATION OF HEALING WITH MASSACHUSETTS INSTITUTE OF TECHNOLOGY

The Gail Holmes Equine Orthopaedic Research Center, in collaboration with the Massachusetts Institute of Technology, recently published an article titled, “Effects of the Combination of Microfracture and Self-Assembling Peptide Filling on the Repair of a Clinically Relevant Trochlear Defect in an Equine Model” in the *Journal of Bone and Joint Surgery*, the most valued source of information for orthopaedic surgeons and researchers over the past 125 years. The authors were Rachel Miller, Ph.D., Alan Grodzinsky, Sc.D., Myra Barrett, M.S., D.V.M., Han-Hwa Hung, B.S., Eliot Frank, Ph.D., Natasha Werpy, D.V.M., Wayne McIlwraith B.V.Sc., Ph.D., and David Frisbie, D.V.M., Ph.D. This study was a continuation of short-term work performed in a rabbit model during a National Institute of Health collaboration with MIT.

As background, articular cartilage defects affect up to 10 percent to 12 percent of the population and, once they become symptomatic, rarely improve without treatment. Marrow stimulation techniques, particularly microfracture, remain the primary treatment option because of their minimal invasiveness and low cost. Despite the short-term improvement noted in sev-

eral microfracture studies, long-term results have been mixed, especially for larger defects. Microfracture repair tissue tends to still be inferior to normal hyaline cartilage. Therefore, the investigation of alternatives to microfracture continues to be an important area of study.

The goal was to augment cartilage defect repair, with or without microfracture, in the horse. This study was performed in order to determine the functionality of a proprietary hydrogel developed by MIT. The injectable self-assembling peptide (KLD) hydrogel was first studied on rabbits with favorable results, suggesting that combining hydrogel with microfracture may offer an improvement over current practice. The best results from the small-animal model was then refined and developed into the equine study.

Defects were treated in four treatment groups: no treatment, only hydrogel, only microfracture, and microfracture followed by hydrogel. Untreated defects and defects treated with only microfracture were used as controls. Horses were given strenuous exercise throughout the one-year study. Evaluations included lameness, arthroscopy, radiography, and gross, histolog-

ic, immunohistochemical, biochemical, and biomechanical analyses.

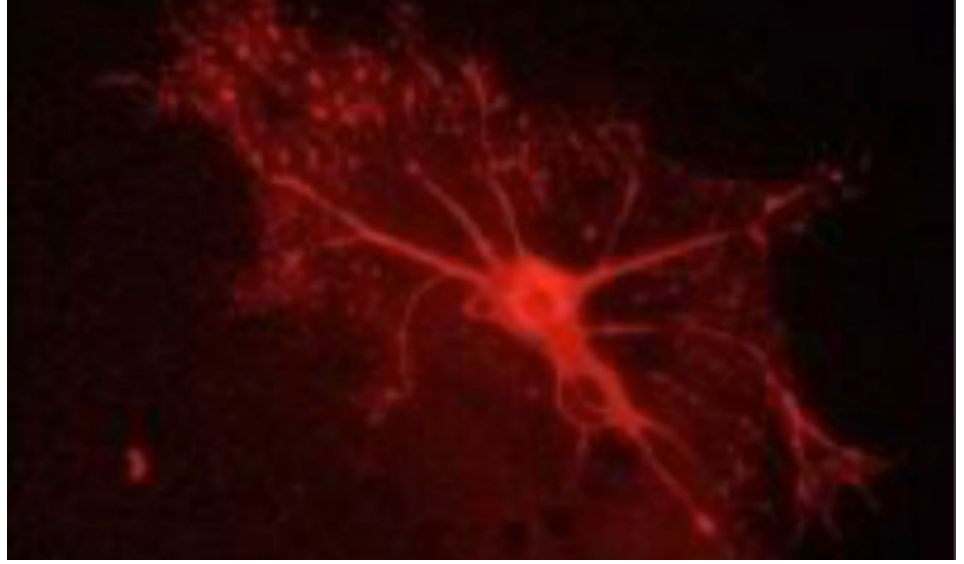
Treatment of defects with hydrogel alone provided some benefits with respect to clinical symptoms. Similarly, treatment with only microfracture also provided some benefits. However, treatment with a combination of microfracture plus hydrogel showed no additional benefits over either treatment alone. The results support human clinical trial results demonstrating short-term benefits with respect to knee function following microfracture.

THE GOAL WAS TO AUGMENT CARTILAGE DEFECT REPAIR, WITH OR WITHOUT MICROFRACTURE, IN THE HORSE. THIS STUDY WAS PERFORMED IN ORDER TO DETERMINE THE FUNCTIONALITY OF A PROPRIETARY HYDROGEL DEVELOPED BY MIT.

In conclusion, the hydrogel did well on its own and there was no additional benefit of microfracture. This is an important piece of information, albeit not what was expected.

The positive data of this project has led us to redefine how we create the defect and how we get integration of healing. We have now written, funded, and started the first step of the continuation of a second NIH grant.

■



DEFINITIVE EVIDENCE FOR VALUE OF MESENCHYMAL STEM CELLS

**THIS WAS THE FIRST CLINICAL
STUDY ASSESSING OUTCOME
RELATIVE TO TIME OF INJURY,
DIAGNOSIS, AND SUBSEQUENT
TREATMENT WITH MESENCHYMAL
STEM CELLS FOR JOINT DISEASE.**

We have continued to get excellent clinical results with joint injury as well as tendon and ligament injury in horses. However, it is also critical to provide peer-reviewed evidence to quantify their benefit. Two significant studies have been published from work at the Gail Holmes Equine Orthopaedic Research Center in the last year.

The first study was a clinical study with a stifle injury in the horse. This was the first clinical study assessing outcome relative to time of injury, diagnosis, and subsequent treatment with mesenchymal stem cells for joint disease. Forty cases with mean follow-up time post treatment of 24 months were reported. These were all cases with femorotibial lesions (meniscal, articular cartilage, or ligamentous) that had had arthroscopic surgery so that the lesions were defined and treated with 20 million bone-marrow derived MSCs intra-articularly approximately four weeks after surgery. All cases had failed routine treatments, and had moderate to severe lesions. 72.5 percent returned to the same level of

work, and 37.5 percent exceeded their prior level of work (an additional 10 horses were still in rehab or reconditioning but had responded well to the treatment at time of follow-up). Of particular excitement was that we had 62.5 percent success rate with grade 3 meniscal tears, and these had previously been reported as having zero percent success in one case and 35 percent success (success defined by returning to work, respectively), which compares very favorably to the other reported series of cases with arthroscopic surgery alone.

The second study was a controlled study in which 20 million MSCs were injected into joints with full thickness cartilage defects treated with microfracture and compared to joints with full thickness defects treated with microfracture alone. At 12 months, there was significantly increased firmness of the repair tissue and significantly increased aggrecan content (it's the critical component that provides compressive strength to our articular cartilage). It is interesting to contrast these successful results with some other studies (one at Cornell and one at CSU), where placement of stem cells in fibrin or fibrin PRP mix had very poor results and rather than enhancing articular cartilage repair caused negative changes. ■

CSU UNVEILS THE ARTEMIS™ LASER, A NEW VETERINARY THERAPEUTIC DEVICE

Colorado State University has recently put into practice the Artemis™ Laser for equine musculoskeletal use. The Artemis™ Laser is the world's most advanced multimodality therapy device for animals. It is meant to work through a photomechanical process in which it mechanically stimulates healing at a tissue level. The portable and easy-to-use system helps with pain relief in the equine athlete by using settings to reduce inflammation and for regenerative therapy purposes.

For laser therapy to be effective, a high level of stimulation

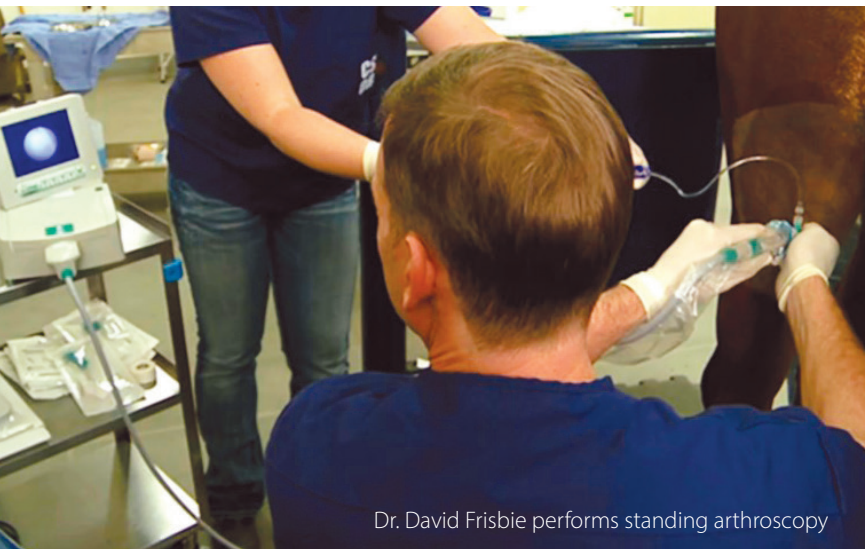
needs to be achieved cumulatively. While each case is unique and a therapeutic goal first needs to be established by the treating veterinarian, frequency of treatment can be expected in the range of two or three times a week for a minimum of a month's time.

The Artemis™ Laser has quickly become a tool in our Equine Sports Medicine practice, offering our clinicians more treatment options and solutions for our clients and patients. At the same time, we are performing a controlled study evaluating this new laser development with support from John and Leslie

Malone, as well as the Louis L. Borick Foundation. ■



FURTHER EVOLUTION OF THE NEEDLE ARTHROSCOPE



Dr. David Frisbie performs standing arthroscopy

In the last edition of *Arthros*, we brought you information about the first investigation using a flexible needle (similar to 18ga needle) arthroscopy to perform standing diagnostic stifle arthroscopy in horses. This technology has really taken flight over the past year, the technique being published in *Veterinary Surgery* and presented in Denmark, Germany, Switzerland, United Kingdom, and in courses taught at CSU and Cornell University. Consequently, veterinarians from California to Switzerland are captivated by the revolutionary technology of evaluating joints without general anesthesia. In addition to performing diagnostic examinations of the stifle, the needle arthroscope has been used in the shoulder joint, navicular bursa, cervical vertebrae, and the carpus, as well as for the removal of bone chips in the hock. “New adopters are embracing the technology every month,” said John Small, president of Biovision Veterinary Endoscopy and manufacturer of the patented NeedleView™ scope. “Dr. David Frisbie put this pioneering technology at the forefront, enabling others to really branch out with it. Each month, someone is using the technology in a new way, and it has made a tremendous difference in the industry.” ■

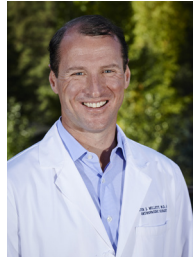
VISITING SPEAKERS 2014

WE HAD A NUMBER OF RENOWNED SPEAKERS VISIT US THIS PAST YEAR. THESE VISITORS ALL PRESENTED EXCELLENT SEMINARS ON THEIR WORK TO OUR GROUP.



PROFESSOR ANTHONY HOLLANDER

Professor Anthony Hollander, the Arthritis Research UK Professor of Rheumatology and Tissue Engineering at the University of Bristol and head of The School of Cellular and Molecular Medicine, visited Colorado State University in March 2014. He has many years of experience in cartilage biology, and his research is particularly focused on osteoarthritis. He also has more general expertise in the wider fields of stem cells and tissue engineering. In 2010, the *Times* newspaper ranking of Britain's 100 most important scientists included him at 39th on the list. His seminar title was "Stem cells, cartilage, and how to save a life."



DR. PETER MILLETT, M.D.

Dr. Peter Millett, surgeon and partner with the Steadman Clinic, specializes in disorders of the shoulder, knee, and elbow. He treats patients with rotator cuff tears, ligament and cartilage injuries, and arthritis, and brings expertise in total shoulder replacement surgery, arthroscopy, and the treatment of shoulder fractures. Dr. Millett presented a seminar on "Rotator cuff tears and repairs: state-of-the-art and clinical outcomes." A particular interest of Dr. Millett's is advanced, arthroscopic surgery where minimally invasive techniques are used to restore damaged ligaments, joints, and bones. His clinical practice is based in Vail, Colo., where he sees approximately 75 patients in the clinical setting and performs approximately 20 shoulder, knee, and elbow surgeries weekly.

2014 SUPPORTERS

With grateful acknowledgement, we thank those who are so critical to the continued success of our program. More specifics on our donor contributions will be included in the 2014 Annual Report.

\$1 MILLION AND ABOVE

Estate of Barbara Cox Anthony
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**BRIAN JOHNSTONE, PH.D.**

Dr. Brian Johnstone, Ph.D., director of research for the Department of Orthopaedics and Rehabilitation at Oregon Health & Science University, presented a special seminar during his visit to the CSU Gail Holmes Equine Orthopaedic Research Center in April 2014. Dr. Johnstone spoke on “Tissue engineering cartilage: the good, the bad, and the ugly.” Dr. Johnstone began his career in skeletal biology in London, U.K., at the Kennedy Institute of Rheumatology, where he subsequently completed his Ph.D. Since coming to the U.S., he has developed a research program centered on stem cell differentiation for musculoskeletal tissues. His laboratory developed the method for in vitro differentiation of stem cells into chondrocytes; a method that was patented and facilitated the field of cartilage tissue engineering from stem cells. He was elected to the presidential line of the Orthopaedic Research Society in 2007 and served as president for 2011-2012.

**SHELIA LAVERTY, M.V.B., MRCVS,
DIPLOMATE ACVS**

Sheila Laverty, full professor in the Department of Veterinary Clinical Sciences, University of Montreal, chief of the Division of Equine Surgery, and director of the Comparative Orthopaedic Research Laboratory, presented the seminar “Imaging the foal epiphysis to understand OCD.” She is a Diplomate of the American and European Colleges of Veterinary Surgery, and her recent honors include the institutional Pfizer research excellence awards in 2002 and 2009. She was co-theme leader of the Diagnostics and Therapeutics theme of the Canadian Arthritis Network (a research center of excellence - 150 researchers - funded by the Canadian government for 12 years to study osteoarthritis in people) and also served on its research advisory and management committees. She is also theme leader of the musculoskeletal section of Thécell (Quebec government-funded cell therapy research network).

**DR. BRIAN COLE, M.D., M.B.A.**

Dr. Brian Cole is a professor in the Department of Orthopedics with a conjoint appointment in the Department of Anatomy and Cell Biology at Rush University Medical Center in Chicago, Ill. In 2011, he was appointed chairman of surgery at Rush Oak Park Hospital. He is the section head of the Cartilage Research and Restoration Center at Rush University Medical Center, a multidisciplinary program specializing in the treatment of arthritis in young active patients. He also serves as the head of the Orthopedic Master’s Program and trains residents and fellows in sports medicine and research. Dr. Cole provided two seminars: “Stem cells, GF, and PRF in the management of OA and cartilage defects” and “Overview of cartilage restoration in humans.”

**ANDY CHRISTENSEN**

Andy Christensen presented the seminar “3-D printing in the medical and virtual surgical planning.” Christensen is the vice president of Personalized Surgery & Medical Devices at 3D Systems. He works to create a more cohesive health care offering spanning provision of software technology, 3-D printing technology, personalized surgery services, and implant production. He is a current board member of the World Craniofacial Foundation and has been involved with the Society of Manufacturing Engineers Rapid Technologies and Additive Manufacturing technical community for many years. He is also a recipient of the SME/RTAM Industry Achievement Award, a prestigious award given for groundbreaking work in the additive manufacturing industry.



ORTHOPAEDIC RESEARCH CENTER

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of Equine Practitioners

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Cutting Horse Owner and Breeder,
Iron Rose Ranch

LARRY BRAMLAGE, D.V.M.

Past President, American Association of
Equine Practitioners, American College
of Veterinary Surgeons; Specialist Equine
Surgeon, Rood & Riddle Equine Hospital

LINDY BURCH

Hall of Fame/Cutting Horse Trainer
and Breeder

MARK DEDOMENICO, M.D.

Thoroughbred Owner and Breeder;
Pegasus Thoroughbred Training
and Rehabilitation Center

RON ELLIS

Thoroughbred Racehorse Trainer

JOHN HALLEY, M.V.B. (D.V.M.)

Veterinarian for Coolmore and
Ballydoyle, Ireland

BOBBY LEWIS, D.V.M.

Elgin Veterinary Hospital; Past President,
American Association of Equine Practitioners

RICHARD MANDELLA

Racing Thoroughbred Racehorse Trainer;
Racing Hall of Fame

WAYNE MCILWRAITH, B.V.Sc. (D.V.M.), PH.D.

Past President, American Association
of Equine Practitioners,
American College of Veterinary Surgeons,
and Veterinary Orthopaedic Society;
Director, Orthopaedic Research Center

MARIA NIARCHOS-GOUAZÉ

Thoroughbred Owner, Europe

DAN ROSENBERG

Rosenberg Thoroughbred Consulting

BARRY SIMON, D.V.M.

Thorn Bioscience

MELANIE SMITH TAYLOR

Olympic Gold Medalist, Show Jumping

JON WINKELRIED

Cutting Horse Breeder; Marvine Ranch

MARTIN WYGOD

Thoroughbred Owner, California;
President and CEO WebMD

2014 GRADUATE STUDENTS AND STAFF



DR. FRANCES PEAT

Dr. Frances Peat joined the Equine Sports Medicine and Rehabilitation Services Residency Program in July 2013. She is the fifth resident in our program that remains unique as the only residency in Equine Sports Medicine and Rehabilitation.

Dr. Peat is from New Zealand and received her veterinary degree from Massey University. She has also done a postgraduate clinical diploma at Massey. She has been in practice for five years at one of the leading equine practices in New Zealand – Matamata Veterinary Services.



CHRISTINE BATTAGLIA

Christine (Chrissy) Battaglia began her appointment at the Gail Holmes Equine Orthopaedic Research Center as a research scientist/lab manager in January 2014. Battaglia attended St. Michael's College in Colchester, Vt., and obtained a B.S. in environmental science. She obtained an M.S. in biochemical toxicology from Virginia-Maryland Regional College of Veterinary Medicine in Blacksburg, Va., in 2001. Shortly after, Battaglia moved to Fort Collins and began working at Colorado State University in the Department of Environmental and Radiological Health Sciences. She has worked in a variety of research areas since her arrival at CSU, including the Center for Environmental Toxicology, Neurobiology, and Radiation Cancer Biology. She looks forward to participating in the exciting research advancements being made at the ORC.



MINDY MEYERS

Melinda Meyers is a research associate with 10 years of experience in the biomedical and biotechnology field. She received a B.S. from the University of Minnesota-Duluth and an M.S. with a focus on equine biotechnology, flow cytometry, and genetic preservation. She was recently hired as a research associate (laboratory) for the Orthopaedic Research Center.



WHITNEY MCMILLAN

Whitney McMillan joined the Equine Sports Medicine and Rehabilitation service at the end of 2014 as a technician. She is a Georgia native and has a bachelor's degree in equine science from CSU. She has been working in equine orthopaedic research since 2005, and now brings her extensive experience to the Equine Sports Medicine team.



LINDSAY RICHARDSON

Lindsay Richardson joined the Equine Sports Medicine and Rehabilitation team as a technician in December 2014. She is originally from Illinois and has a bachelor's degree in animal science from CSU. She has several years of experience working at the Orthopaedic Research Center and assisting in equine research projects. She is currently attending the Front Range Community College Veterinary Technician Program and will become a certified veterinary technician in 2016.

NEW FACULTY AND PROMOTIONS



DR. CHRIS KAWCAK

Dr. Chris Kawcak is a professor and the Iron Rose Ranch University Chair in Musculoskeletal Research, and has recently been made director of Equine Clinical Services. We have not lost him from our Orthopaedic Research Center and, as part of his new clinical role, achieved funding for Dr. Valerie Moorman as an assistant professor to aid in his research.



DR. KEVIN HAUSSLER

Dr. Kevin Haussler was promoted to associate professor and granted tenure July 1, 2014. Dr. Haussler has continued research interests in objective assessment of musculoskeletal pain and spinal dysfunction, and evaluation of rehabilitation approaches to both large and small animals. Congratulations, Dr. Haussler!



DR. MYRA BARRETT

Dr. Myra Barrett has become a tenure-track assistant professor and head of the Equine Imaging Service, which includes all modalities of clinical diagnostic imaging of horses, training of diagnostic imaging residents, equine diagnostic imaging interns and fellows and equine sports medicine residents, as well as imaging components of ORC research. This is a major breakthrough, as academic institutions have typically had Departments of Radiology somewhat divorced from the equine clinicians, per se, and certainly not equine-focused.

Dr. Barrett earned her D.V.M. from CSU, and completed an internship at Oak Ridge Equine Hospital, followed by a nonconforming radiology residency at CSU to focus on equine diagnostic imaging. Dr. Barrett also obtained a master's degree within the ORC, working on follow-up of yearling radiographs in cutting horses. After achieving Diplomate status in the American College of Veterinary Radiology she stayed on at CSU as a special appointment faculty until accepting the new position.



DR. MELINDA STORY

Dr. Melinda Story joined us in 2013 as an assistant professor in Equine Sports Medicine and Rehabilitation (but this was not included in the last edition of *Arthros*). Dr. Story obtained her D.V.M. from Colorado State University and did a surgical residency at Kansas State and became board certified as a Diplomate of the American College of Veterinary Surgeons. She was a surgeon at Littleton Large Animal Clinic, and then made the move to CSU so she could be part of our Equine Sports Medicine and Rehabilitation Program. Since joining the faculty, Dr. Story has passed the examination for the American College of Veterinary Sports Medicine and Rehabilitation and is making great contributions to our team. In addition, because she was doing the equine musculoskeletal work for Leslie Malone's dressage horses at Harmony Sporthorses, she initiated the relationship between John and Leslie Malone and our group!



DR. ERIN CONTINO

Dr. Erin Contino recently joined our faculty as an equine Fellow in imaging and is going to become an Assistant Professor in the Equine Sports Medicine and Rehabilitation Program this year. Dr. Contino is a Colorado State University D.V.M. graduate, who, after interning at Pioneer Equine Hospital, did a three-year Sports Medicine and Rehabilitation residency at CSU (completed June 30, 2014), then passed the examination to become a Diplomate of the American College of Sports Medicine and Rehabilitation in August 2014. Before and during her time as a D.V.M. student, she also completed an M.S. at the Orthopaedic Research Center.



DR. TAMMY HAUT DONAHUE

Dr. Tammy Haut Donahue was promoted to full professor in 2014. She was also named member-at-large of the executive committee of the American Society of Mechanical Engineers' Bioengineering Division. Drs. Tammy Haut Donahue and Christian Donahue had articles that were recognized in the *Journal of Biomechanical Engineering* and selected as one of the Editors' Choice papers for 2014. Congratulations, Dr. Haut Donahue!



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DIRECTOR

Dr. Wayne McIlwraith

EDITOR

Kristy Wygmans

GRAPHIC DESIGN

Communications and Creative
Services, Colorado State University

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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IN MEMORIAM | DR. JOHN MILTON SPARKS



DR. JOHN MILTON SPARKS III, D.V.M., loyal friend to the Orthopaedic Research Center, passed away in November. His childhood was spent in Arizona where he desired to become a veterinarian at a young age. Dr. Sparks majored in livestock production at Arizona State University and attended Colorado State University for his Doctorate in Veterinary Medicine. He then entered the U.S. Air Force as a veterinarian, and his practice included animals used in the U.S. space program. After serving his country, Dr. Sparks returned to Arizona to begin the Bar S Animal Clinic. His practice was both small and large animals, but equine was his passion. He assisted in the development of the Budkirk Nature Plate horseshoe. In 1975, he moved to New Jersey to begin a specialty in equine medicine serving racetracks. Two years later, Dr. Sparks returned to Scottsdale, Ariz., to continue his equine practice. He served all breeds of horses, but focused on working with breeders of Arabians. He and his wife, Karen, participated in Arabian horse shows throughout the U.S. and Canada, showing their own horses and winning several national titles.

IN MEMORIAM | RICHARD GOODING



RICHARD L. GOODING, 67, of Cherry Hills Village, Colo., passed away on Sunday, June 1, 2014, after his courageous 11-year struggle with melanoma. Gooding was born in Denver in 1946 and grew up in the Belcaro neighborhood. He attended South High School in Denver. Gooding's grandfather, James A. Gooding, started the Pepsi Cola Bottling Company of Denver in 1936, which originally served all of Colorado and parts of surrounding states. Gooding's father, James A. Gooding Jr., took over ownership and management responsibilities when his father retired and, in turn, Gooding became the owner and chief executive officer from 1979 until 1988, when he sold the company back to the parent corporation, PepsiCo. He served on the board of directors of several entities, including the National Western Stock Show. Gooding was a quiet and generous philanthropist who did not enjoy the limelight, nor accolades or recognition for his many contributions. He was more comfortable flying under the radar. Richard Gooding and his wife, Nancy, were good friends and supporters of the ORC.

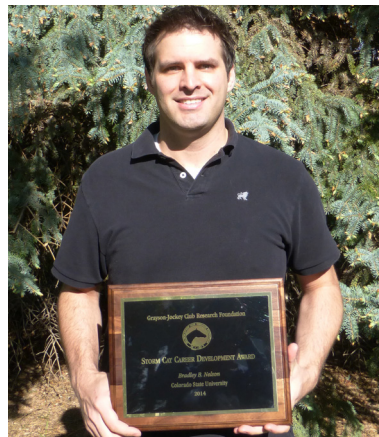
2014 AWARDS



DR. WAYNE MCILWRAITH
ORS Marshall R. Urist, MD Award

DR. WAYNE MCILWRAITH received the Marshall R. Urist, MD Award from the Orthopaedic Research Society for Excellence in Tissue Regeneration Research in March 2014. As stated by the ORS, "This prestigious award honors an investigator who established him/herself as a cutting-edge researcher in tissue regeneration research and has done so with a sustained ongoing body of focused research in this area of tissue regeneration as it relates to the musculoskeletal system." This is the first time the award has been given to a veterinarian, and it is a great honor for the research productivity of the ORC.

DR. BRAD NELSON
AAEP Past-President's Scholarship
and Grayson-Jockey Club Research
Foundation Storm Cat Career
Development Award



DR. BRAD NELSON received the AAEP Past-President's Scholarship in 2014 that is awarded to a veterinarian who is undergoing postgraduate research training. In 2014, Dr. Nelson also received the Grayson-Jockey Club Research Foundation Storm Cat Career Development Award.



DR. AIMEE COLBATH
One AO Award

DR. AIMEE COLBATH was chosen from the ACVS Surgery Summit in 2014 to receive the One AO Award and presented her abstract at the One AO meeting in February 2015. The title of the presentation was "Comparison of the Immunosuppressive Properties of Allogeneic and Autologous Equine Bone Marrow-Derived Mesenchymal Stem Cells." This research project was co-authored by Drs. Wayne McIlwraith, Steven Dow, and Laurie Goodrich, and research associate, Jennifer N. Phillips.



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