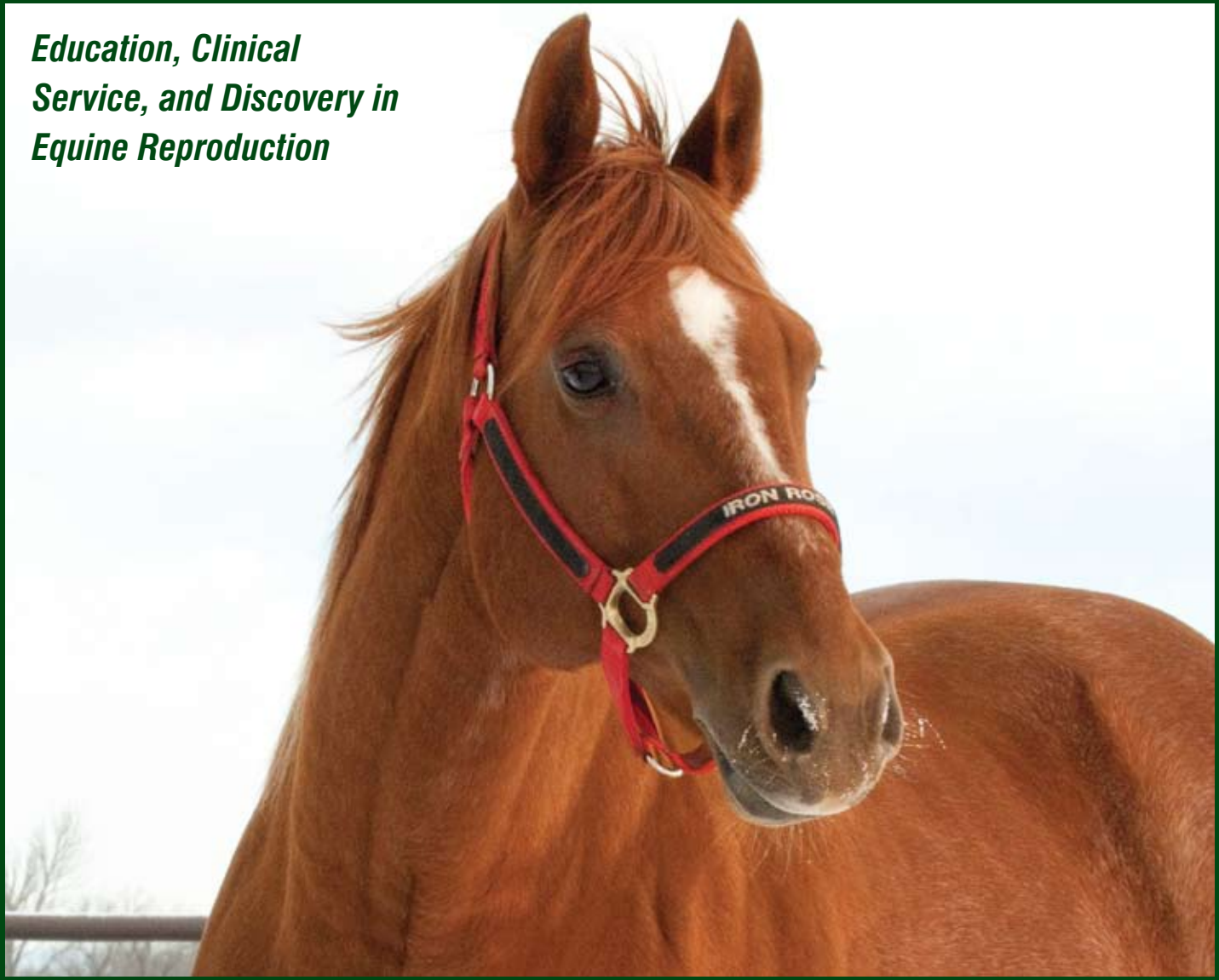
Equine Reproduction Laboratory

2009 Edition

Animal Reproduction and Biotechnology Laboratory • Department of Biomedical Sciences

Education, Clinical Service, and Discovery in Equine Reproduction



Colorado State University

College of Veterinary Medicine and Biomedical Sciences

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Equine Reproduction Laboratory

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Lisa Dell, left. and Terrie Murphy staff the front desk at the ERL.

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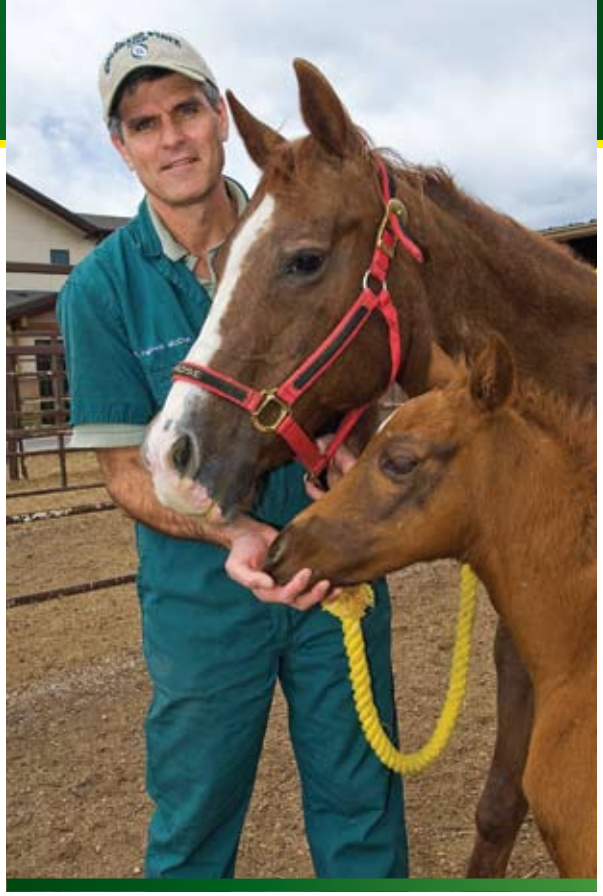
The Equine Reproduction Laboratory Magazine *is published annually by Colorado State's Equine Reproduction Laboratory and produced by the Department of Communications and Creative Services. The Equine Reproduction Laboratory is part of the Animal Reproduction and Biotechnology Laboratory, in the Department of Biomedical Sciences, College of Veterinary Medicine and Biomedical Sciences at Colorado State University. We welcome your questions, comments, and story suggestions. You can e-mail your comments to Carol Borchert,* ERL Magazine *Editor, at* ***carol.borchert@colostate.edu****. You also can visit us on the Web at* ***www.cvmbs.colostate.edu/bms/ERL****.*

Welcome from the *Director...*



Dr. Patrick McCue, ERL Director

People are the core of a successful program and, at Colorado State University, we have some of the best people in the field of equine reproduction. In the first edition of the *Equine Reproduction Laboratory Magazine*, you met the faculty. In this issue, you'll be introduced to the heart and soul of our program, the technicians who actually run the place. These individuals maintain the focus, consistency, and stability of our clinical services. In addition, this issue will highlight how technical advances at Colorado State University have dramatically impacted the lives of our clinical patients and their owners. For example:

On May 22, 2008, a devastating tornado hit the small town of Windsor, Colo. One person was killed, 850 homes were damaged or destroyed, and damage estimates were near $175 million. For families in the area with horses and cattle, there was the loss of animal life as well. Tuesday, a beloved buckskin mare owned by Jennifer Mears, was one of those victims. Her leg shattered by a falling shed, Tuesday was taken to the James L. Voss Veterinary Teaching Hospital where veterinarians realized they wouldn't be able to save the horse. But they could save her future foals with quick action, advanced reproductive technology at the ERL, and a little bit of luck.

At the Equine Reproduction Laboratory, we value discovery as it relates to clinical cases and the research we perform is often directly applicable to our clinical service. New discoveries mean new applications and new hope to horse owners like Jennifer Mears. In this edition of the *Equine Reproduction Laboratory Magazine*, you'll learn more about Tuesday and the innovative clinical procedures that resulted in two pregnancies. You'll also read the clinical case of Woodrow, a foal abandoned by his mother, on the brink of death, and saved by a combination of technology, compassion, and dedication. You'll learn more about our research programs and about the people who make all this wonderful work possible, particularly the research associates, interns, graduate students, and residents.

> The national economy may be down, but our enthusiasm for quality clinical service, education, and discovery is not.

Of course, excellence in education and service also are hallmarks of the Equine Reproduction Laboratory, and we pride ourselves on offering quality programs at all levels and disciplines. Our students include not only undergraduate and graduate students, but also veterinarians, farm managers, and horse owners. This year, for the first time, we presented an innovative short course for horse owners on emergency foaling procedures to help them assist their horses until professional assistance arrives.

You'll read about all this and more in our annual magazine. The national economy may be down, but our enthusiasm for quality clinical service, education, and discovery is not. We look forward to an outstanding 2009 breeding season. Meanwhile, we hope you enjoy the stories and look forward to hearing your feedback, as well as seeing you at the Equine Reproduction Laboratory soon. And keep an eye on our website at www.cvmbs.colostate.edu/bms/erl. As soon as Tuesday's foals arrive, we'll let you know.

Best Regards,

Pat McCue

Dr. Patrick McCue, Director
Equine Reproduction Laboratory

Jennifer Mears, far right, with her family, the ERL team, and surrogate mares

Tuesday

Twister Brings Tragedy to Horse Owner

Jennifer Mears would often describe her horse Tuesday as her best friend. The 11-year-old buckskin mare was gentle and affectionate, and Mears looked forward to their times together, just riding or talking or walking. Their friendship came to a sudden end on May 22, 2008, when a devastating tornado hit the town of Windsor, Colo.

The tornado arrived at 11:18 a.m. and spent 30 minutes tearing a path through Weld County. One person was killed, 850 homes were damaged or destroyed, and damage estimates were near $175 million. For families in the area with horses and cattle, there was the loss of animal life as well. Tuesday was injured when the shed she was standing behind blew over.

Tuesday was taken to the James L. Voss Veterinary Teaching Hospital at Colorado State University where radiographs revealed she had a fracture to her lower hind leg. Euthanasia was the only option. Mears' hopes were dashed – Tuesday not only was her best friend, but she had planned to breed the mare to preserve her genetic line and gentle personality, passing on that trait to her offspring. Tuesday had already proven herself to be a good mother with two previous foals, and Mears was looking forward to more babies.

"The hospital medical staff had the foresight to inform Tuesday's owner that there was a possibility that a pregnancy could still be obtained from Tuesday if her ovaries were recovered at the time of euthanasia," said Dr. Patrick McCue of the Equine Reproduction Laboratory, where assisted reproductive technology has enjoyed major advances in the last 20 years. "In the midst of tragedy, there was reason for hope."

Early the next day, Tuesday was put under anesthesia, her ovaries removed, and she was quietly and humanely put to sleep. Her ovaries were immediately taken to the ERL where a total of 20 oocytes (eggs) were harvested and incubated in a special medium for 24 hours. Donated semen from a friend's stallion also was brought to the ERL. On the following day, 14 of the oocytes were each injected with a single spermatozoon using a technique called intracytoplasmic sperm injection (ICSI). The fertilized eggs were then returned to the incubation medium. The waiting and watching began to see if any of the eggs would divide and develop into embryos.

Meanwhile, the ERL veterinary staff began the search for recipient mares, looking first to the mares of Mears and her neighbors, then to the ERL herd. Four potential surrogate mares were identified and, seven days after Tuesday was euthanized, four growing embryos were transferred nonsurgically into the mares. The mare from the ERL herd was renamed Friday in honor of Tuesday.

"We performed pregnancy examinations one week after the transfer and found two of the four mares, including Friday, to be pregnant with an embryo from Tuesday," said Dr. McCue. "The mares should be foaling out in April and we are looking forward to the arrival of Tuesday's foals. We are excited for the Mears family, and very happy that we were able to help them in a small way to make it through a difficult time."

Tuesday gave birth to two foals during her life. Technological advances, including embryo transfer and ICSI, are giving her a chance to have two more offspring following her death. Though no other horse can replace Tuesday, for Mears and her family the next best thing may well be a Wednesday and a Thursday (or Saturday and Sunday?). ÷

Check The Charts – A Success Story

A technician places stallion semen in a centrifuge.

John Underhill and Jim Young of JSY Racing in Fort Lupton, Colo., had every reason to be joyful as the new owners of a stallion they hoped would put their racing program on the map. Check The Charts, a son of the great Beduino, had won more than $240,000 in racing during the early 1980s. This achievement earned him a Register of Merit and the designation of Superior Race Horse by the American Quarter Horse Association (AQHA). He also had sired offspring that had won a combined total of nearly $1.8 million.

Their joy, however, was short-lived. Just a few weeks after arriving in Colorado from Texas, the 20-year old stallion contracted colitis – a severe inflammatory condition of the digestive system. Check The Charts was taken immediately to the James L. Voss Veterinary Teaching Hospital at Colorado State University where he underwent life-saving treatment. During his stay, Check The Charts suffered a secondary complication – priapism, a persistent erection of the penis which required additional surgery. As a consequence of the priapism and the surgery, his penis subsequently lacked the sensation that would allow him to get an erection and breed mares normally.

The staff at the Veterinary Teaching Hospital had saved Check The Charts' life, but if he could not breed mares his owners were looking at a very expensive stallion that would add nothing to their breeding program. Check The Charts was transported to the Equine Reproduction Laboratory for additional testing and treatment, with the hope that he would one day be able to breed.

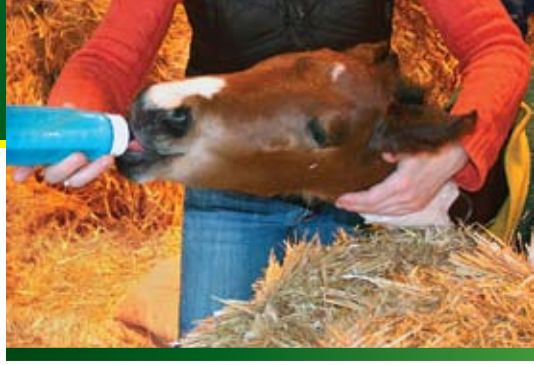
"Check The Charts was a great horse to work with," said Paula Moffett, a Research Associate with the ERL. "He had been 'around the block' by this stage of his life and was a real gentleman. We tried to collect semen from him, and although he was very interested and would mount mares, he could not ejaculate."

While this may have been the final hope to the owners of the breeding stallion, the ERL was not ready to give up. One of the many services the ERL provides is a procedure known as "chemical ejaculation." This involves giving the stallion a combination of medications that can cause ejaculation without an erection or mounting a mare. The difficulty is that horses do not always respond to the treatment in a consistent manner.

Dr. Jason Bruemmer, Associate Professor in the Department of Animal Sciences and coordinator of the ERL stallion service, and Moffett put Check The Charts on a program for chemical collection. The first time they tried the procedure, the stallion ejaculated, and his semen was frozen. This ensured that the genetics of this great stallion were preserved and could potentially be used to impregnate mares. However, up to this point, there was no record of any foals being produced from frozen semen that was collected via chemical ejaculation. Other veterinarians who had collected semen by this method had always bred mares immediately with fresh semen. The researchers didn't know with certainty if mares would get pregnant with chemically ejaculated semen that had been frozen.

During the next several months, the ERL staff continued the chemical ejaculation protocol, adjusting the dosage as they went along. Out of 15 attempts, they collected semen five times and froze the semen each time. Seven mares were bred with the frozen semen and four of the mares became pregnant. This was the first recorded instance of mares becoming pregnant with semen frozen from chemical ejaculation.

Before coming to the Equine Reproduction Laboratory, Check The Charts' future as a breeding stallion seemed to be finished. Thanks to the dedication of the staff and the advanced reproductive techniques offered by the ERL, Check The Charts' genetics were preserved for future generations. More importantly, this stallion was again able to sire foals and became the first stallion to produce foals with frozen semen obtained by chemical collection. ÷



Woodrow

Foal Gets a Rough Start in Life

Foals born in the middle of winter, in the snow, more than three weeks early, unattended, and to a maiden mare with less-than-ideal mothering credentials, usually don't fare too well in a rough and tumble world. But Woodrow has shown that even in the direst circumstances, determination and quality care can be enough to beat the odds.

Woodrow's story began a year ago, when he made his early entrance into the world, born to a maiden mare in the cold of night. His first night may have been his last if not for the efforts of an attentive farm manager and the veterinary medical team at the Equine Reproduction Laboratory. The farm manager found the newborn foal cold and weak in a snow bank. Wrapped in a blanket, piled into the back seat of an SUV, Woodrow made the trip to Colorado State University and the ERL where his condition was assessed and treatment begun.

The foal was hypothermic, dehydrated, shocky, and had a very weak suckle response. His medical team began treatment immediately with warmed intravenous fluids, plasma, antibiotics, naval disinfection, heat lamps, a warm water pad, blankets, and lots of one-on-one attention from an army of students determined to see the colt make it through his first day. A nasogastric tube also was put in place to deliver colostrum directly to the foal's stomach, and milk replacer was fed by a bottle every one to two hours.

Woodrow also was the beneficiary of a new test developed at the ERL that can quickly and accurately show the level of antibody (IgG) in the blood.

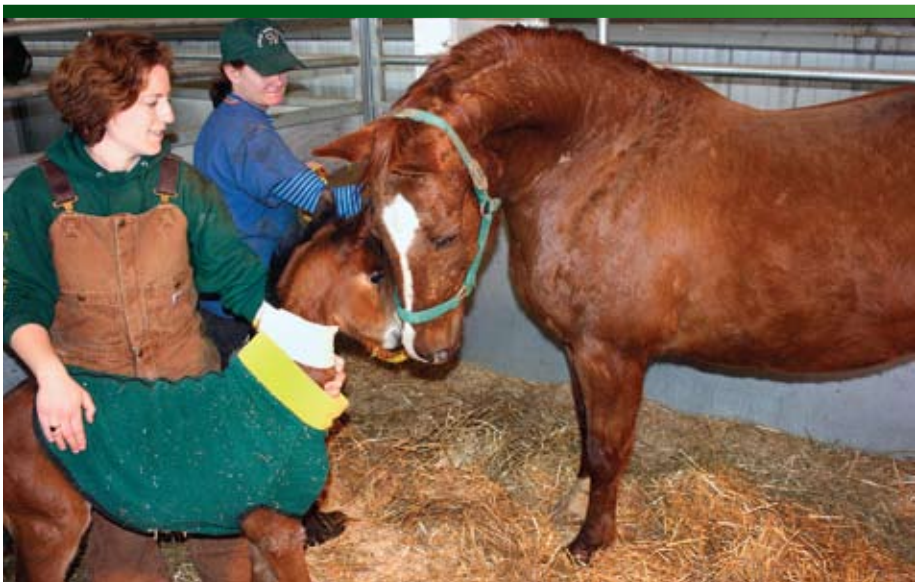
"At the ERL, we developed a blood test for measurement of antibody levels that yields immediate results," said Dr. Patrick McCue, Woodrow's attending clinician. "With Woodrow, the test showed his antibody levels were inadequate and that he would benefit from additional antibody in the form of frozen-thawed colostrum and plasma to provide immune protection against infectious disease."

After two hours of treatment, Woodrow began to improve. His mother was brought to the clinic but attempts to reunite the mare with her foal were unsuccessful. Eventually, a suitable surrogate mare was selected from the ERL herd and treated with hormones to stimulate her to come into milk. Woodrow's adoptive mom, who had a history of being a good mother to a previous foal of her own, allowed the orphan to nurse and his future looked promising.

But Woodrow wasn't out of the woods yet. Radiographs taken at 4 days of age showed Woodrow's knees and hocks had incomplete ossification of the bones of those joints, probably due to his premature birth. He was fitted with a set of splints and ordered to "bed rest" for almost three weeks, still able to stand and nurse, but with limited exercise. At 12 days old, Woodrow developed another medical condition, called a patent urachus, and an umbilical infection. During fetal development the urachus is a tube that connects the bladder to the umbilicus. After birth, the urachus normally closes. If the urachus remains open, the risk of infection is very high. Woodrow had surgery to remove the infected umbilical stump. The clinical staff waited for the next medical crisis, but Woodrow's troubles seemed to finally be over.

At one month, Woodrow was discharged from the clinic and returned with his adopted mom back to the ranch where his life began with so much uncertainty. Today, he roams a 40-acre pasture near Fort Collins where his spunk and spirit bring delight to all. Woodrow is a survivor thanks to state-of-the-art veterinary medical care, dedicated students, and a compassionate owner. ✣

Woodrow with his surrogate mom



Foaling Short Course
Helps Horse Owners and Breeding Farm Managers

A one-of-a-kind, hands-on short course in foaling out mares was offered to owners and breeders by the Equine Reproduction Laboratory in January 2009.

Unlike most classroom-only courses, this short course combined classroom learning with actual "wet lab" experiences to help owners work in partnership with their veterinarians to obtain a live, healthy foal. Participants were able to obtain "hands-in" experience using facsimile mares to learn how to determine the foal's position.

"We are trying to teach owners and foaling attendants how to recognize what is normal for a foaling and what is abnormal," said Dr. Patrick McCue. "Most mares foal out unassisted with no problems, but there are emergency situations when a horse owner will need to call their veterinarian and will need to know what to do until the veterinarian arrives. Training in emergency care for the mare and foal can make the difference between life and death."

Dr. McCue said the short course offered levels of emergency training similar to what one might find in a human CPR or first-aid course, but more in-depth and geared toward the mare and her foal. Many mare owners or new foaling attendants have limited foaling experience and do not know what to expect. The course taught them how to recognize the stages of foaling as well as steps to take in emergency situations, emphasizing appropriate decision-making to optimize a successful outcome.

Lecture topics included care of the late-term pregnant mare, prediction of foaling, normal foaling, routine care of the newborn foal, complications of pregnancy and foaling, foal resuscitation, problems in the post-foaling mare, and medical issues of the newborn foal.

Foaling short course participants determine a "foal's" position in a facsimile mare.

"This course took the fear out of the unknown! Although I hope to never encounter foaling problems, I now feel better prepared to either handle them or call for help."

– Course Participant

Laboratory sessions included:

- Appropriate on-farm methods to assist with delivery of foals and when to call for assistance in a difficult foaling.
- Proper on-farm use of foal resuscitation equipment and techniques.
- Examination of the placenta.
- Methods to predict foaling.
- Use of labor-alert devices.
- Evaluation of colostrum quality.
- How to test for passive transfer of maternal antibodies.

The Equine Reproduction Laboratory plans to offer the foaling course again next year. Information will be available on our website at www.cvmbs.colostate.edu/bms/erl. ÷

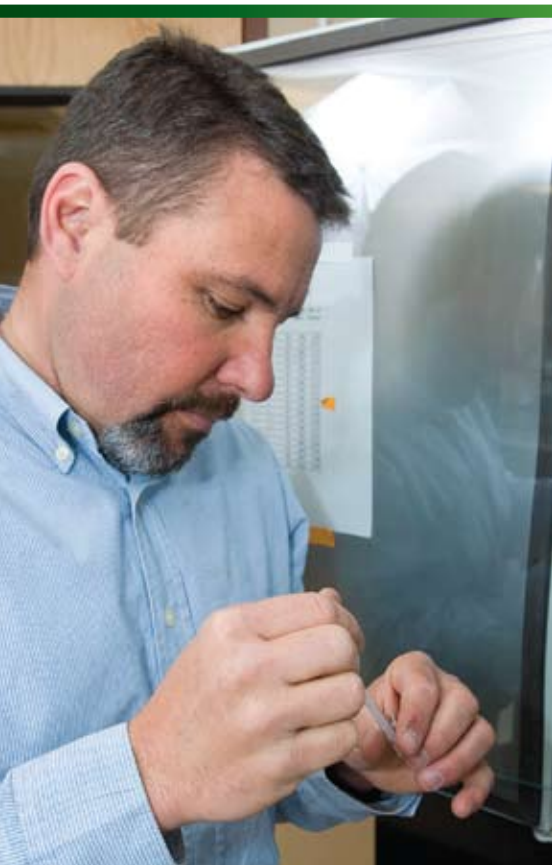
Research Focus

Research Seeks to Solve Mystery of Pregnancy Recognition in the Mare

If a woman is pregnant, an early pregnancy test can reliably and rapidly confirm the pregnancy usually within the first two weeks after fertilization. Human pregnancy tests detect the presence of the hormone human chorionic gonadotropin (hCG), which the embryo begins to produce shortly after it attaches to the woman's uterine lining. The hCG hormone tells a woman's body she's pregnant and a whole cascade of changes begins to occur.

Scientists at the Equine Reproduction Laboratory are trying to discover how horses know when they're pregnant – they are looking for the hormonal "primer" that will help explain the events that follow fertilization of the oocyte (egg). Such a discovery may also help researchers develop an equine early pregnancy test, a test that looks for a telltale sign of pregnancy, similar to hCG in humans.

Dr. Jason Bruemmer



"We understand the mechanisms of early pregnancy signaling in humans, cattle, sheep, pigs, and just about every other domestic animal," said Dr. Jason Bruemmer, an Associate Professor in the Department of Animal Sciences and faculty member in the Equine Reproduction Laboratory. "The horse remains a mystery, but I think we are getting closer to understanding what happens after the fertilized oocyte reaches the uterus."

Once fertilized, the developing embryo remains in the oviduct for about five days, and then descends into the uterus. The embryo is already dividing by the time it reaches the uterus. The embryo then migrates around the uterus for 12 days, until it finally "fixes" in a position within the uterus. Dr. Bruemmer is particularly interested in what is happening to the embryo and the uterus when the embryo is making its rounds.

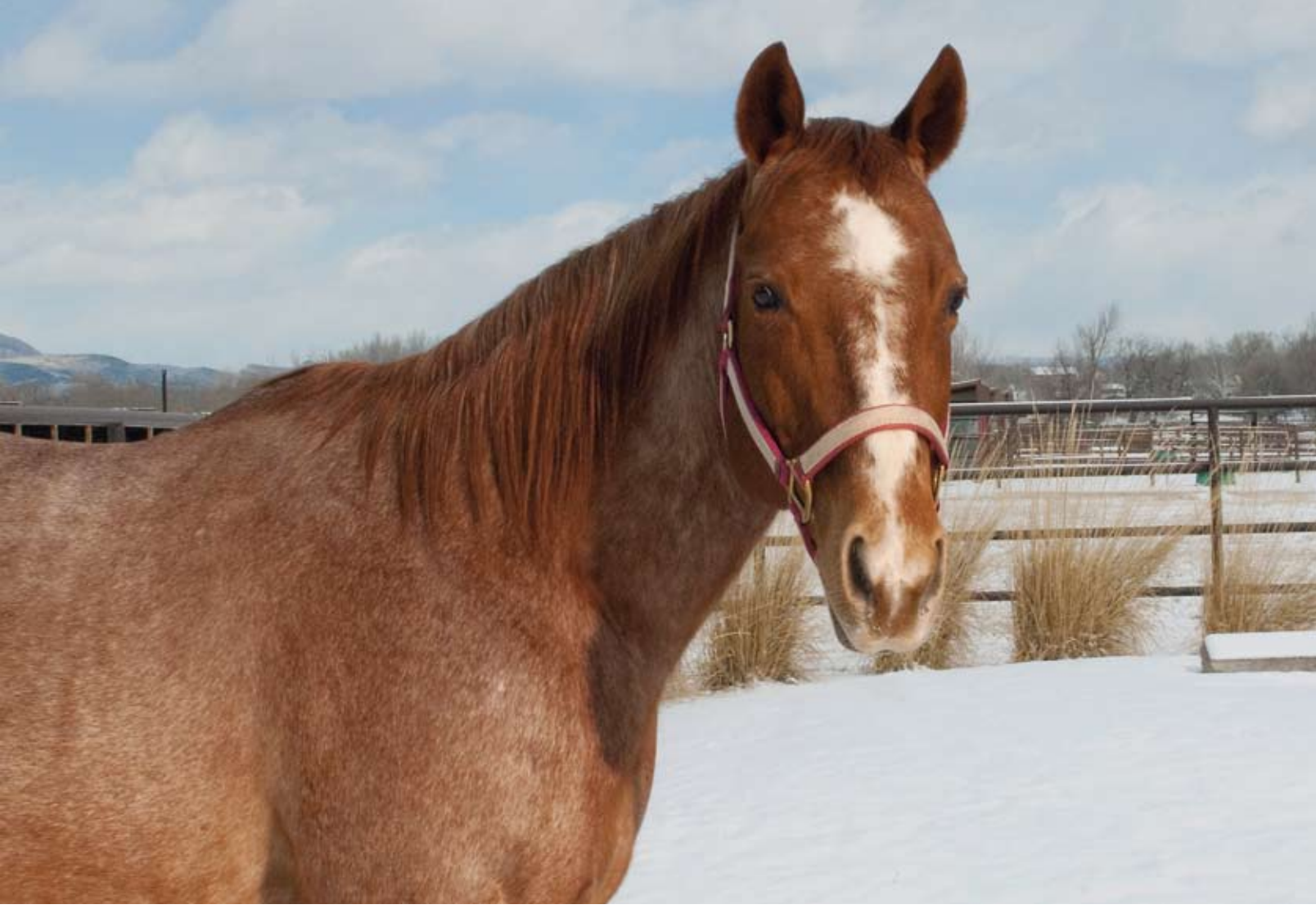
"Our hypothesis before we began our research was that the first physiologic change is detected in the uterus," said Dr. Bruemmer. "To test that, we took uterine samples from the same mare when pregnant and not pregnant, in various stages of her cycle and pregnancy, looking for differences in products of the uterine cells."

The next step is to isolate RNA and, using the equine gene chip, screen to see what is different between pregnant and non-pregnant mares. The gene chip will show which genes are turned on or off. Dr. Bruemmer first used an equine gene chip two years ago that had an incomplete set of 3,300 equine genes on the chip. He is now waiting for a gene chip with the entire equine genome, currently under development at the University of Kentucky's Gluck Equine Research Center. Dr. Bruemmer is working with UK's Dr. James MacLeod on the project. The new gene chip will give Dr. Bruemmer a complete picture of what is happening at the genomic level in pregnant mares.

Dr. Bruemmer's research team also is working with the Proteomics and Metabolomics Facility at Colorado State University looking for metabolites that appear in blood and are specific to the pregnant mare. One of these might be a potential blood marker for early pregnancy. The lab's most recent research looked at endometrial cells to see if there is a triggering mechanism in those cells that signals pregnancy to the mare. Of particular interest to the research team is the role that oxytocin plays in establishment of pregnancy.

"We are looking at this from every possible angle not only because of the potential to help maintain pregnancies in horses, or to develop an early pregnancy test, but because it is an intriguing question that no one has come up with an answer for, yet," said Dr. Bruemmer. "We are making some exciting discoveries and I think we are getting closer. The next few months will give us a good idea as to whether or not we are on the right track."

Dr. Bruemmer's work is supported with funding from the Preservation of Equine Genetics at Colorado State University. +



Bet Yer Blue Boons

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Paula Moffett

Research Associate Explores Interest in Horse Reproduction

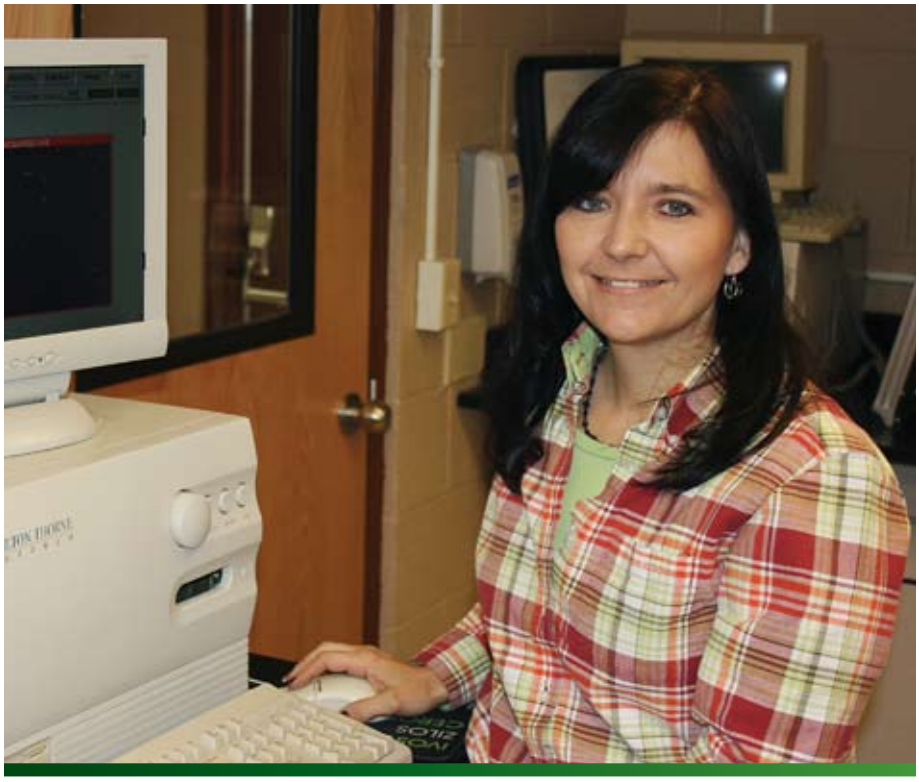
Most children don't receive a horse for their first birthday, but that wasn't unusual in Paula Moffett's household. Her dad had participated in local rodeos and had worked as a horse trader. Moffett and her siblings grew up riding and doing farm chores – and developing a special kinship with horses. That love of horses, coupled with a love of learning, inspired Moffett to pursue becoming a veterinarian.

Growing up, Moffett lived in Parsons, Kan., and Collinsville, Okla., and then moved to Rockland, Idaho, where she graduated from high school. She eventually moved back to Kansas and attended a local community college, where she did a basic studies program for two years. She then applied to Oklahoma State University and was accepted into the Agricultural Science and Natural Resources program with a pre-veterinary major.

"I packed up and moved to a place where I had no friends and no family and put myself through school," said Moffett. "I wanted to make my family proud, especially my mom, and receive a degree that I hoped would lead to a great career."

After completing her undergraduate work, Moffett applied to veterinary school at Oklahoma State University but was not accepted. Looking for other options, Moffett came upon the Equine Reproduction Laboratory at Colorado State University. She moved to Fort Collins in 2001, starting out as a volunteer at the ERL with a desire to continue her education.

Faculty members could see the potential Moffett had to succeed in the field of equine reproduction and encouraged her to seek a master's degree. She applied and was accepted into the program. She soon moved into a more permanent position in the lab as a research associate and eventually completed her degree.

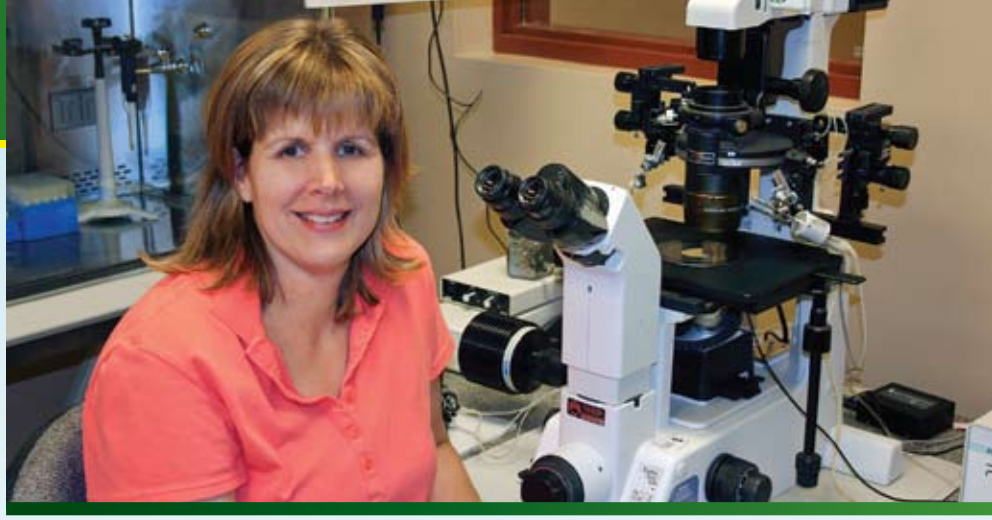


Paula Moffett

Moffett now works with Dr. Jason Bruemmer in the commercial stallion program. She helps with all aspects of assisted reproduction of the stallion, the management of stallions standing at the ERL and outpatient stallions, as well as coordinating stallions for ongoing research projects. She helps organize short courses, keeps the laboratory running with supplies, manages the frozen semen inventory, including frozen semen destined for export, and is a great help to new graduate students who are learning the ins and outs of the ERL.

"My own children see me as a role model and they know school is very important," said Moffett. "I have been in school almost my whole life, and now I'm working at a job I love. I enjoy working in equine reproduction, and I get to be with great horses and great people, so this is a good fit for me. It is amazing working at the ERL knowing the laboratory is internationally known for its advances in equine reproduction."

With hard work and dedication, the dream of a bigger life for Moffett and her family became reality. She now lives north of Fort Collins, has her own horse, a career she loves, and has completed a master's degree. This, she says, is where she wants to be. +



JoAnne Stokes

JoAnne Stokes

Path Through Dairy Farm Brings Animal Reproduction Specialist to ERL

Unlike other research associates at the Equine Reproduction Laboratory, JoAnne Stokes' first love wasn't horses, it was cows. That's to be expected given that she grew up on a dairy farm in Ohio, showed cows and calves in 4-H, went to Nationals in the Dairy Bowl (the dairy version of the Academic Challenge), and was a member of her 4-H Dairy Judging Team that went to state to compete. She backed up that practical experience with a degree in Dairy Science from Ohio State University. So how does she explain winding up in equine reproduction?

"I was interested in reproduction and that interest grew after I took several classes in the field," said Stokes. "After I graduated, I sent résumés to areas I might like to move to, including Colorado, and sent one to Dr. George Seidel at the Animal Reproduction and Biotechnology Laboratory. He didn't have any positions at the time, but knew someone in Pennsylvania who needed a new technician, so he forwarded on my résumé."

Stokes began to work for a private company in Pennsylvania doing bovine embryo transfer (ET) and in vitro fertilization (IVF). When the company was sold 12 years later, she transferred to Texas for two years where she worked with Dr. Charles Looney at Ovagenix in ET and IVF, and then for Genetic Savings and Clone, with Dr. Chuck Long. The biotechnology market at that time was beginning to destabilize, so Stokes decided to call her old boss from Pennsylvania who had been a graduate student at Colorado State University to see if he knew of any open positions.

"I came to Fort Collins to visit a friend for the Thanksgiving holiday and Dr. John Hasler called me to say that I had an interview with Dr. Ed Squires the day after Thanksgiving," said Stokes. "I started work for Colorado State University on Feb. 1, 2003, and now work with Dr. Elaine Carnevale primarily in assisted reproductive technologies (ART) in both the commercial and research programs at the ERL. In a roundabout way, I have Dr. Seidel to thank for my job."

Stokes is responsible for organizing the laboratory and is the go-to person for intracytoplasmic sperm injection (ICSI). ICSI is a valuable reproductive tool for infertile or low sperm count/low performance stallions, as well as for stallions that have died, but whose owners wish to continue the stallion's genetic line. Stokes spends most of her time in the laboratory, especially in May, June, and July when research programs kick into high gear and workloads increase.

"We are finding out more about the mare, and how young mares and old mares compare in terms of the differences in their oocytes and embryos," said Stokes. "We are exploring new areas of ICSI, as well as culturing and freezing embryos. The ERL is always an exciting place to be because we are on the forefront of assisted reproductive technology. And, the end product is great. We get a recipient pregnant and, eventually, a foal is born, so it makes all the hard work worthwhile."

The key to her success in the laboratory, said Stokes, is timing and communication. Particularly in equine ART, thinking ahead and knowing what's coming next is critical. This is especially true in equine reproduction when so much relies on precise schedules in the mare's cycle and development of the oocyte to embryo. Her years of experience, and calmness in the face of a storm, allow others to whirl around her while she efficiently gets ready for medical procedures, handles sperm preparation and oocyte injection, works with clients, provides hands-on education for students, and helps faculty members reach their research, clinical, and outreach objectives.

Over time, Stokes has made the transition from cows to horses – she even has a horse of her own, now – but the dairy cow will always hold a special place in her memory. ✣

Jillian Wall

Breeding Farm Manager Intern Takes on New Role

Jillian Wall's love of horses started out like most girls – she and her younger sister begged and begged until their parents finally agreed to let the girls join the U.S. Pony Club and start riding lessons. Every day, Wall's mother drove her daughters to the next town so they could experience the demand of caring for horses. The girls were allowed to ride only after grooming the ponies and cleaning the ponies' stalls. Her parents thought the girls would outgrow their passion, tire of cleaning stalls, and move on to their next childhood dream – little did they realize Wall's passion for horses was just beginning.

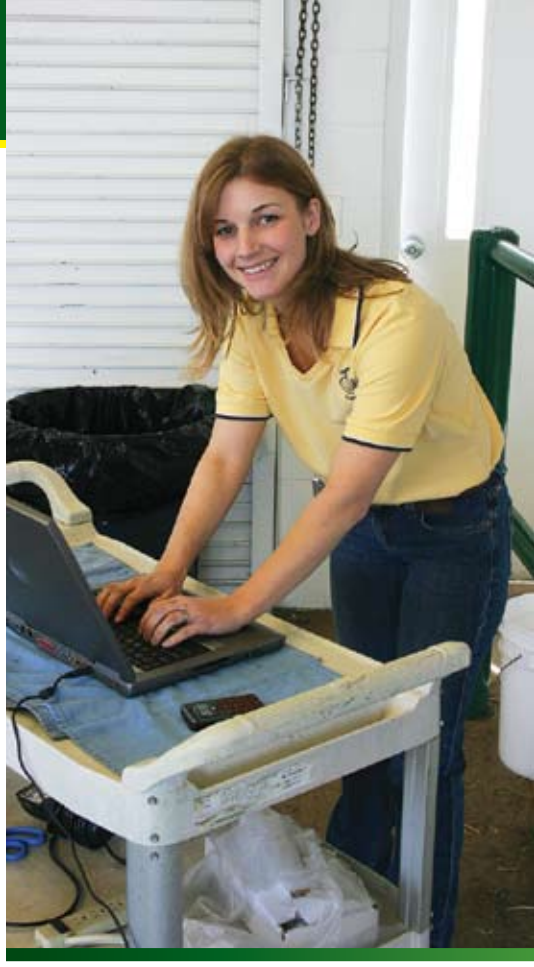
Within six months, the family was looking to purchase their first horse. Six months later, they started looking for their second horse (now fully aware it was impossible for two daughters to share one horse). Before long, they had bought acreage in the country, built a six-stall barn, and their small herd began to grow.

Wall, who is now a Research Associate at the Equine Reproduction Laboratory, took her love of horses with her to college, attending Kansas State University where she received her bachelor's degree in animal science. Interested in becoming a breeding farm manager, she was accepted for an internship at Babcock Ranch in Valley View, Texas, where she worked with cutting and reining horses. After working there for a breeding season, Wall applied to the Breeding Farm Manager internship program at Colorado State University, looking to gain a comprehensive knowledge of equine reproduction. The yearlong internship exposes interns to all aspects of mare and stallion management while preparing them to manage a fast-paced commercial breeding operation.

"Interns live on site, so we are the first ones here in the morning and the last ones here at night," said Wall, who was accepted into the program and began her internship in July 2007. "It's a difficult internship, but it gives a taste of what it's like to be working in the industry."

Her work and experience at Babcock Ranch and the ERL impressed Dr. Patrick McCue, who was looking to bring in a new research associate. Wall also had worked at the Kansas State University Veterinary Medical Teaching Hospital while an undergraduate student, gaining valuable experience in clinical medicine, which gave her an even greater skill set. After completing her internship, Wall signed on as a research associate at the ERL and took on new responsibilities.

In the off season, she keeps up with client communications and has been gathering and analyzing data for a retrospective study on embryo transfer. As the breeding season begins, she'll be in charge of the new microbiology laboratory, analyzing uterine and semen cultures. She's also involved with the supervision of client-owned broodmares and foals, as well as embryo transfer recipient mares. Wall is taking on instructional responsibilities, assisting in undergraduate, graduate, and veterinary student education in equine reproduction, as well as assisting in professional and client short courses, including the new foaling class for horse owners and breeding managers.



Jillian Wall

"I hope to be in this industry and in this job for a significant period of time," said Wall. "I also hope to pursue my graduate education, staying in the field of reproduction, particularly equine embryo work, and maybe one day human embryos. Every choice I have made in the past has helped me to become more focused in my career and further define the direction I would like to take."

Wall's love of horses remains and her horse family has expanded to include miniatures (her stallion has won six world championships). The miniatures entered her life after Wall suffered a ruptured spleen in a jumping accident and was unable to ride for a year. Her parents, who thought their girls would outgrow horses, now have five horses on the family ranch they built outside of McPherson, Kan. It's funny and wonderful, notes Wall, how passionate her parents have become about their horses – maybe they'll outgrow it. ✣

Wish List for the ERL

For those who wish to make an equipment contribution to the Equine Reproduction Laboratory to advance our missions in teaching, research, and outreach, we have a short list of items currently needed for our program. Call (970) 491-8626 for additional information or to inquire about our matching fund plan.

Item	Use	Approximate Cost
Compound Microscope (with camera)	Teaching groups of students and horse owners about sperm morphology, uterine cytology, and endometrial biopsy interpretation.	$4,000*
HDV Digital Camcorder	Record equine reproduction events (i.e., foaling) and procedures (i.e., embryo transfer) for teaching.	$3,000*
Lactate Analyzer	Measure blood lactate levels to monitor health status in normal and critically ill foals for teaching and clinical service.	$350

*Ask about our matching fund plan

I Would Like to Support the Work of the Equine Reproduction Laboratory

Gifts to the Colorado State University Equine Reproduction Laboratory are used to fund undergraduate and graduate scholarships, support startup and established research programs, and provide discretionary funds to the ERL Director for use where most needed. If you would like to make a donation in support of the laboratory's needs and goals, please complete the form below and return with your gift. If you have any questions on making a donation to the ERL, please contact Paul Maffey, Director of Development, College of Veterinary Medicine and Biomedical Sciences, at paul.maffey@colostate.edu or (970) 491-3932. Please note that you also may make your donation at our secure online site as listed below.

Colorado State University Equine Reproduction Laboratory

Yes! I/we would like to support the work of the Equine Reproduction Laboratory.

Enclosed is my/our check for a gift of:
❑ $50 ❑ $100 ❑ $200 ❑ Other $ _____
(Payable to Colorado State University Foundation)

Name _____

This gift is from ❑me ❑my spouse & me ❑my partner & me.

Spouse's/Partner's Full Name _____

Address _____

City, State, ZIP _____

Home Phone (_____) _____

E-mail _____ ❑Home ❑Work

❑ A matching gift form is enclosed.

Make a gift online at:
https://advancing.colostate.edu/BMS/ERL/GIVE

❑ Charge this gift of $ _____ to my/our
❑ VISA ❑ MasterCard ❑ American Express

Card Number _____
Expires _____/_____ (mm/yy)
Name on Card _____
Signature _____

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Please return this form with your gift to: CSU Foundation, P.O. Box 1870, Fort Collins, CO 80522-1870

ERL Residents, Graduate Students, and Interns

Essential to Research, Outreach, and Clinical Services

The Equine Reproduction Laboratory is fortunate to attract many of the finest residents, graduate students, and interns in the biomedical sciences and animal sciences to its research, teaching, and clinical services programs. These individuals assist faculty members in client care, are deeply involved in ongoing theriogenology research as well as developing their own research projects, and assist in short courses and continuing education. The next time you're at the lab, stop by and say hi.

Residents

Catie DeLuca, DVM
Hometown: Washington, D.C.
Bachelor's Degree: Vanderbilt University
DVM: Virginia-Maryland Regional College of Veterinary Medicine
Resident in Equine Reproduction under Dr. Patrick McCue

Ryan Ferris, DVM
Hometown: Soap Lake, Wash.
Bachelor's Degree: University of Idaho
DVM: Washington State University
Resident in Equine Reproduction under Dr. McCue

Graduate Students

Bernardo de Lima Rodrigues, DVM
Hometown: Belo Horizonte, Brazil
DVM: Federal University of Viçosa, Brazil
Master's student in Biomedical Sciences under Dr. Elaine Carnevale

Ryan Brooks
Hometown: Huntersville, N.C.
Bachelor's Degree: Virginia Tech, Animal Science
Master's student in Animal Science under Dr. David Denniston

Ellane Cleys
Hometown: Charleston, S.C.
Bachelor's Degree: University of Arizona, transfer to Oregon State University, Animal Science
Master's student in Animal Science under Dr. Jason Bruemmer

Riki Cullingford
Hometown: Monroe, Conn.
Bachelor's Degree: Cornell University
Master's student in Biomedical Sciences under Dr. George Seidel

Brad Daigneault
Hometown: Bandera, Texas
Bachelor's Degree: Texas A&M University, Animal Science
Master's student in Biomedical Sciences under Dr. Carnevale

Amanda Krull
Hometown: Colorado Springs, Colo.
Bachelor's Degree: Colorado State University, Equine Science
Master's Student in Animal Sciences under Dr. Bruemmer

Gretchen Lund
Hometown: San Luis Obispo, Calif.
Bachelor's Degree: Cal Poly State University
Master's student in Biomedical Sciences under Dr. Carnevale

Beth Spizziri
Hometown: Ryegate, Mont.
Bachelor's Degree: Montana State University, Animal Sciences
Master's Degree: Colorado State University, Biomedical Sciences
Doctoral student in Biomedical Sciences under Dr. James Graham

Rebecca Yourey
Hometown: Hegins, Pa.
Bachelor's Degree: University of Pittsburgh
Master's student in Biomedical Sciences under Dr. Carnevale

Interns

Heidi Jo Hughes
Hometown: Cambridge, Minn.
Bachelor's Degree: North Dakota State University, double-major Equine Science and Animal Science, minor in Agricultural Business
Intern in Equine Breeding Farm Management

Alison Parker
Hometown: Herndon, Va.
Bachelor's Degree: Virginia Tech, Animal and Poultry Sciences with an Equine Emphasis and a Business Production option
Intern in the Equine Breeding Farm Management ÷

(Photo courtesy of the Society for Theriogenology)

The annual Dr. Jerry Rains Memorial Graduate Student Competition was held during the 2008 Theriogenology Conference and Symposia in St. Louis, Mo., Aug. 12-16, and Colorado State University was well represented. From left to right are: Lori McParlin, Cornell University; Drs. Christianne Magee, Catherine DeLuca, and Erica Gee, all from Colorado State University; and Dr. Hannah Galantino-Homer, chair of the abstract competition committee.

Dr. Gee, a CSU Resident in Equine Reproduction, took first place in the abstract competition with her paper "Efficacy of medroxyprogesterone acetate in suppression of estrus behavior and follicular activity in cycling mares;" Dr. DeLuca, also a CSU Resident in Equine Reproduction, took second place with her paper "Comparison of 3 doses of reFSH for superovulation in mares;" and Dr. Magee, a graduate student in the Animal Reproduction and Biotechnology Laboratory, took third place with her paper "Luteinizing Hormone-Induced release by kisspeptide in primary cultures of equine pituitary cells." The competition was sponsored by Intervet-Schering Plough Animal Health.

Clinical Services

Equine Reproduction Laboratory

The Equine Reproduction Laboratory at Colorado State University provides four areas of clinical service to meet the needs of its clients. These include the Mare Service, Stallion Service, ART (Assisted Reproductive Technologies) Service, and Foaling Service. Through ongoing research and clinical programs, we are always working to enhance and expand our clinical services to best serve our clients and to help preserve some of the most important genetic lines in the equine world.

Mare Service

The Mare Service provides horse owners with the most current technology available for the reproductive management of their mares. Services include breeding by live-cover and artificial insemination with fresh, shipped-cooled, or frozen-thawed semen. Depending on the needs of the owners, breeding services can be provided on an outpatient (mares trailer-in) or inpatient basis (mares are housed at the ERL). Embryo transfer services also are provided for mares that might not be capable of carrying their own foal to term or if more than one foal is desired from a mare in a given season. Mares with reproductive problems offer a special challenge and an opportunity to test the diagnostic and therapeutic skills of the ERL staff.

The Equine Reproduction Laboratory offers a comprehensive set of assisted reproductive technologies.

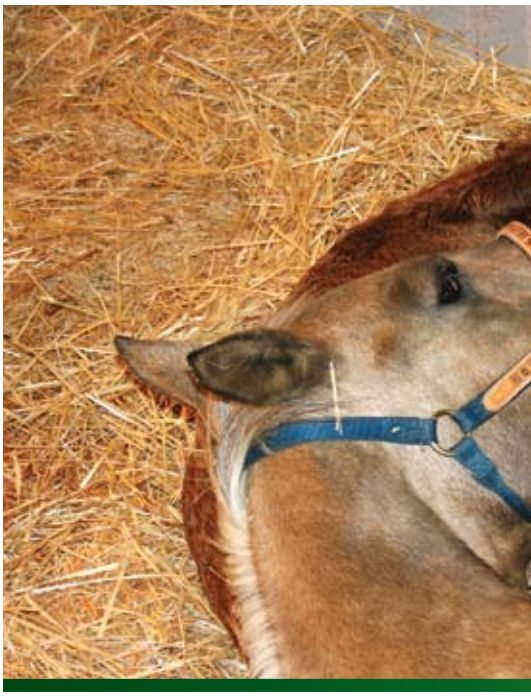
Stallion Service

The ERL offers a full range of commercial stallion services including breeding soundness evaluation of the stallion; semen collection, evaluation, and processing for fresh or cooled-transported use; and infectious disease diagnostic testing. We provide stallion owners with the most current technology available for the reproductive management of their stallions. A related area is the Equine Semen Freezing Service which provides a commercial equine semen freezing and storage service approved by the USDA for international export.

During the initial visit, the stallion undergoes a complete breeding soundness evaluation and collected semen is frozen using different semen-freezing techniques to determine the optimal method of freezing semen for each individual stallion. Stallions may be housed at the ERL until the desired amount of semen is procured and cryopreserved. The ERL also offers on-site storage facilities or transport to other locations for long-term storage of frozen semen.

ART Service

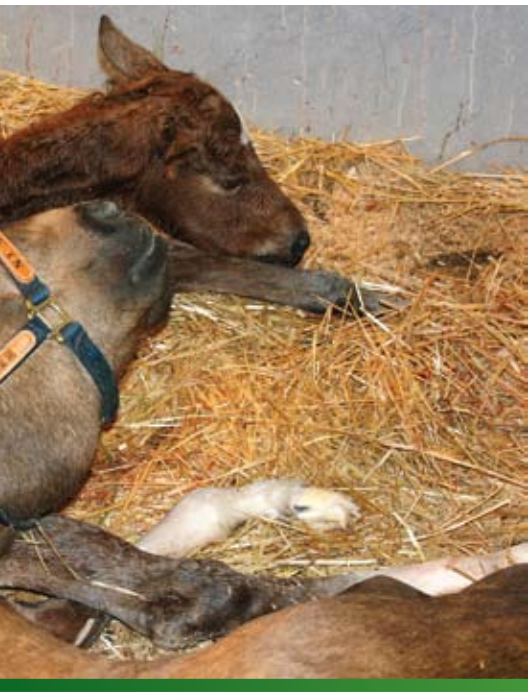
For stallions or mares that present breeding challenges or unique situations, the Equine Reproduction Laboratory offers a comprehensive set of assisted reproductive technologies (ART) including oocyte transfer and intracytoplasmic sperm injection (ICSI). Mares not capable of becoming pregnant or producing



embryos for transfer have the option of oocyte transfer. This involves the placement of the donor mare's eggs into a recipient mare's fallopian tube (oviduct). The recipient mare is artificially inseminated before the transfer, so fertilization of the donor egg and subsequent embryo development occur within the reproductive tract of the recipient mare.

We also offer intracytoplasmic sperm injection which involves micro-injection of a single sperm cell into the mature donor egg, resulting in fertilization. This technique is particularly useful for producing foals from stallions with low numbers of sperm or poor sperm quality. After fertilization, the injected egg is placed into the fallopian tube of a recipient mare or incubated for several days prior to nonsurgical transfer into the uterus of a recipient mare.

In the case of catastrophic illness or sudden death of a mare, her ovaries may be shipped to the ERL, where her eggs (oocytes) are harvested and subsequently fertilized.



Foaling Service

For owners interested in foaling out their pregnant mares, the ERL accepts a limited number of mares into its Foaling Service. The service includes 24-hour monitoring, foaling stalls, screening to predict foaling, a veterinarian on call for each foaling, and medical services, including umbilical cord care, evaluation of passive immunity transfer, deworming the mare to reduce the risk of parasite infestation, and postpartum examinations of both the mare and the foal.

We welcome your inquiries regarding any of our services. For additional information and service fees, visit our website at www.cvmbs.colostate.edu/bms/erl. You also may phone or fax inquiries to: phone (970) 491-8626 or fax (970) 491-7005.

The Equine Reproduction Laboratory is part of the Animal Reproduction and Biotechnology Laboratory, Department of Biomedical Sciences, College of Veterinary Medicine and Biomedical Sciences at Colorado State University. ✣

10th Annual Stallion Auction Benefits Equine Programs

Equine reproduction and orthopedic programs at Colorado State University were the beneficiaries of the 10th Annual Stallion Auction held Jan. 14-17. Stud fees for more than 80 stallions were on the auction block with the proceeds benefiting the Equine Reproduction Laboratory and the Equine Orthopaedic Research Center. Approximately $50,000 was raised for research and teaching programs in the ERL.

"This investment in the ERL by both the stallion owners and the auction participants is greatly appreciated and makes us want to work even harder for our clients," said Dr. Patrick McCue. "Their confidence in our program is a reflection of the dedication of our faculty and staff, and the advances we are making in equine reproductive science."

The stallions represented champion cutting, reining, and racing bloodlines. Many stallion owners participating in the auction are longtime supporters of Colorado State's equine programs. Stallions included CD Olena, donated by Bar H Ranch; CD Lights donated by Winston Hansma; Bob's Freckle, Playdox, and That Sly Cat donated by Slate River Ranch; WR This Cats Smart donated by Wagonhound Land and Livestock Co.; and High Brow Cat, donated by Jack and Susan Waggoner from Bridgeport, Texas. The Waggoners donated two breeding fees from their champion cutting stallion.

"The best veterinarians we've had experience with are from Colorado State's Veterinary Teaching Hospital. We're giving back to them because they have taken such wonderful care of our animals," said Jack Waggoner. High Brow Cat has been named the NCHA Sire of the Year, AQHA Leading NCHA Sire, and the Equi-State Leading Cutting Sire for five years in a row. ✣

Floyd Miller

Unique Perspective on ERL Advisory Board

Early in his life, Floyd Miller, a member of the Equine Reproduction Laboratory Advisory Board, was destined to be a veterinarian. At 14, he started working at a fish store, then was promoted to the pet store. He trained as a veterinary technician and then, at 16, he moved out of his family's home and lived in a veterinary hospital for six years. He assisted in emergencies and animal care, pursued a degree in biochemistry – until he realized something important. Some of his experiences at the veterinary hospital had taken the shine off his chosen career and he didn't want to be a veterinarian anymore.

"At that point, I was confused and didn't know what to do next," said Miller. "Up until then, everything I had done had been to eventually become a veterinarian. When I realized it wasn't the right thing for me, I was totally lost."

Miller was pointed toward computers, and began working as a programmer. He attended San Jose State University where he double-majored in marketing and advertising, with a minor in economics. After college, he moved to San Francisco, hoping to get a start in an agency. He finally landed a job with a company that had a small account with a new tech firm that wanted an advertising rep who was versed in programming and advertising. That small account was Microsoft and as the computer giant grew, so did Miller's opportunities.

He went on to other positions at other agencies before deciding to start his own company, which he eventually sold, though he stayed on to manage global operations. After the economic disruptions caused by the terrorist attacks of 9/11, Miller left advertising, packed up (including four Percheron horses) and moved to Hawaii where he, just by chance, got involved in the cattle industry and helped start the Maui Cattle Company. He also was exposed to real cowboys riding real working horses.

"It was really fun and really exciting, and sparked an interest for me in horses," said Miller. "I decided to leave Hawaii, though I still own a portion of the Maui Cattle Company, and go live someplace where I could have horses."

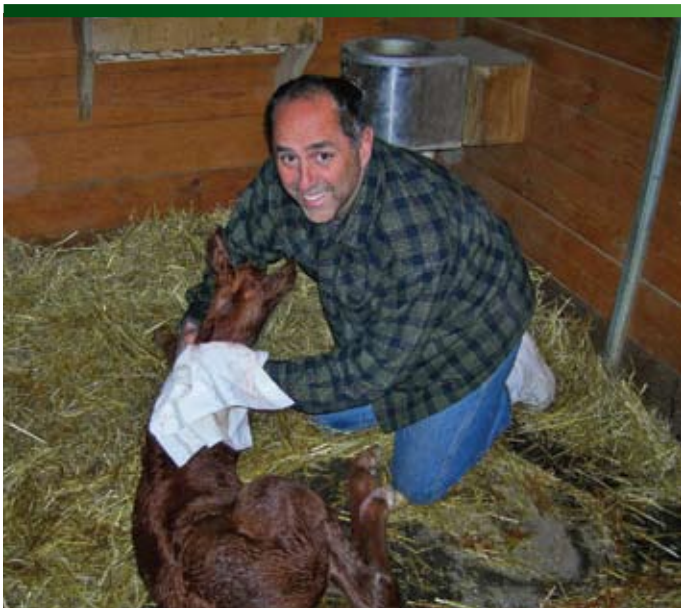
Miller found his dream location just outside of Durango, Colo., on the Cottonwood Springs Ranch, a nearly 600-acre property fully set for a "gentleman's ranch." Before he knew it, he was in the performance horse business. Miller was a quick study and set out determined to become one of the premiere breeding farms of American Quarter Horses in the United States. He now has 20 broodmares with 100 horses on the property and will foal out 35 babies this year. Miller is supported in his equine endeavors by his partner of 20 years and his 10-year-old daughter.

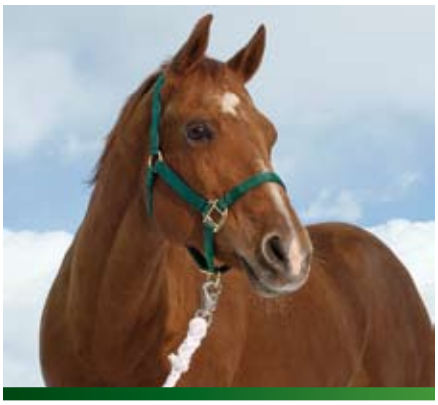
Miller became involved with Colorado State University after he took a short course at the Equine Reproduction Laboratory. When Dr. Patrick McCue, Director of the ERL, asked Miller to join the Advisory Board, he decided his expertise in marketing might bring a different perspective to the board.

"CSU is undervalued, underappreciated and an incredible resource," said Miller. "When I look at some of the things going on at the ERL and the world-class talent, I'm just amazed. There is a tremendous upside potential that can snowball with better resources, better funding, and better grants. I hope to do whatever I can to advance the program with my business strategy and communication skills."

As far as his dream of being a veterinarian, Miller might want to rethink that – veterinary skills are certainly in high demand on his ranch where he not only has his horse business (including his Percherons, Puanani and Kookea), but where he also has (at least) four barn cats, an African Gray parrot, a cockatoo, three golden retrievers, two Australian shepherds, and two Jack Russell terriers. Paging Dr. Miller… ✣

Floyd Miller





Flashy Zippers Best

Equine Reproduction Laboratory Advisory Board 2009-2010

The Equine Reproduction Laboratory Advisory Board provides valuable input to the ERL on research, outreach, and educational programs. Board members also serve as ambassadors for the ERL in the greater equine community. The board meets annually to provide guidance to the ERL.

Members are:

Dr. Ed Blach
Veterinary Consultant; Monument, Colo.

Gail Holmes
Quarter Horse Owner and Breeder; Fort Worth, Texas

Dr. Phil Matthews
Equine Veterinarian; Ocala, Fla.

Floyd Miller
Quarter Horse Owner and Breeder; Bayfield, Colo.

Phil Rapp
Quarter Horse Owner, Breeder, and Trainer; Weatherford, Texas

Dr. Kirk Shiner
Equine Veterinarian; McCoy, Colo. ÷

Welcome Dr. Judy Merriott

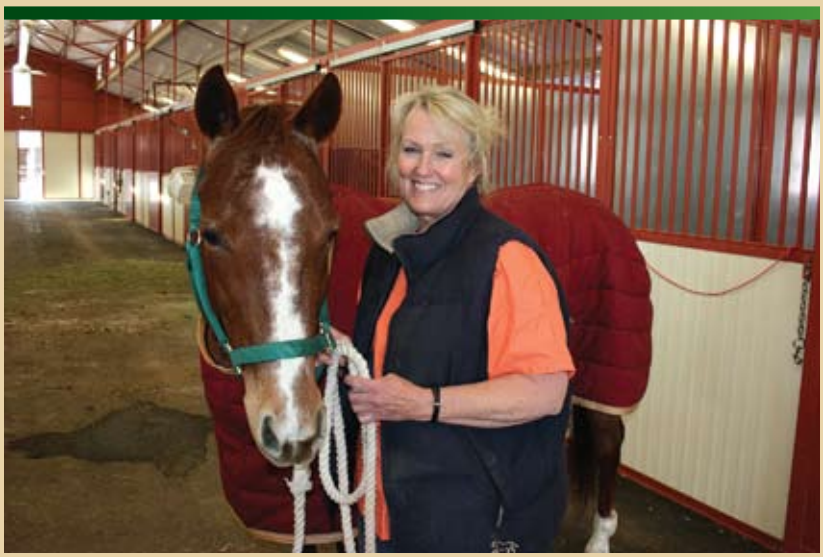
Dr. Judy Merriott, a 2001 graduate of the Professional Veterinary Medical Program at Colorado State University, has joined the Equine Reproduction Laboratory as a staff veterinarian, assisting Dr. Elaine Carnevale in the Assisted Reproductive Technology (ART) Service.

"We are very pleased to welcome Dr. Merriott to the Equine Reproduction Laboratory team and appreciate the depth of knowledge she brings to our program," said Dr. Patrick McCue. "Dr. Merriott had a private equine practice for eight years and has a practical understanding of equine reproduction from her field experiences that will enrich our program and help us better meet the needs of our clients."

Dr. Merriott is originally from Michigan and completed undergraduate work in public relations at the University of Michigan. She worked in public relations for General Motors for 12 years before moving to Jackson, Wyo., where she worked at the Jackson Hole ski resort. She also worked part time for her veterinarian, who encouraged her to go back to school to get her degree in veterinary medicine. Dr. Merriott enrolled in the pre-vet program at the University of Wyoming, then applied and was accepted to the PVM program at Colorado State University.

"My first job out of school was as resident veterinarian on a breeding farm, and following that I established my own practice in Longmont," said Dr. Merriott. "Though I enjoyed my work and met so many wonderful people, when this opportunity came up at the ERL, it was like coming home. It's feels great to be here, and having the opportunity to work with Dr. Carnevale is just incredible."

The ERL welcomes Dr. Merriott and wishes her the best of luck in all her endeavors. ÷



Dr. Judy Merriott

Equine Reproduction Laboratory

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