

Equine Guelph

Research Update

Fall 2011



Genomic Road Map to Rhodococcus

Opens New Expressway to Vaccine Development

Imagine a three decade journey — a quest for an insidious bacterium possessing elusive qualities equivalent to that of the Holy Grail. Dr. John Prescott, University of Guelph Professor and Chair of the OVC Department of Pathobiology, has been unwavering in staying the course on his quest to find a vaccine to combat the deadly *Rhodococcus* bacterium. *Rhodococcus* (*R. equi*) is no bug on the windshield that can be easily wiped off. Once this air-borne organism leaves Point A (soil and manure) to travel to Point B (the lungs of a young foal) it hides in the very macrophages that should normally seek out and destroy invading bacteria. The advent of genomic research has opened up a super highway full of new information. Since the recent mapping of the *R. equi* genome (published 2010), the destination for a vaccine is not far away.

The need for a vaccine is great. *R. equi* can stow away inside a young foal undetected for months. By the time symptoms of panting and coughing first appear (usually at the same time horse owners are busily bringing in their hay), the only course of action is the expensive and time-consuming administration of antibiotics.

Dr. Prescott and his team are collaborating internationally to tackle this global disease. Prescott's former M.Sc. student, Iain MacArthur, is also committed to seeing this epic journey through and works closely with Prescott online using Skype. MacArthur is currently working on his doctorate at the University of Edinburgh and runs tests using

micro-arrays. This entails printing every *Rhodococcus* gene onto a slide and looking at their expressions under different conditions. MacArthur explains the advantages of having the blueprint for the *R. equi* genome, "Instead of hunting around a cave with a tiny flashlight — we can now switch the lights on, view all contents and see how the genetic material relates."

"This level of understanding would have been considered almost science fiction just a few years ago; it is incredible what we can do with this new genomic technology," exclaims Prescott. The advances in research, since 2003, when the human genome project mapped out all the sequence of DNA in the body, have been truly incredible. When looking at all 5,000 genes in the *R. equi* sequence, one is now able to assign a function to each — a task which simply was not possible before mapping the *R. equi* genome. The high beams are on and researchers are able to see all the genes that are switched on — the complete blueprint. They now know what makes this organism a pathogen, what it needs to live and how it works. Prescott and MacArthur are isolating and targeting the most switched on and linked genes to develop a weakened form of the live virulent which could then be orally administered as a vaccine.

So the million dollar question breeders want to know regarding the road to a Rhodococcus vaccine — "Are we there yet?" Not far now!

-By: Jackie Bellamy



R. equi loves hot dusty environments and lurks in soil and manure.

Early warning signs for *R. Equi*:

- coughing or panting
- young foal may go off feed or stop suckling

Preventative measures:

- avoid sandy environments
- don't overcrowd paddocks

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Great Strides Toward Detecting EPO Use

In the thick of her research, Dr. Dorothee Bienzle has made progress in the search for an adequate blood test to eliminate the use of erythropoietin (EPO). Preliminary testing suggests that the concept of a “blood passport” may be a viable way to identify the use of the drug before horses are exposed to the hazards of repeated EPO injections.

Conscientious horse owners would never put their animals at risk for stroke, heart attack or death. However, improper use of EPO can cause all the aforementioned. The short-term gain of increasing red blood cell production, and therefore oxygen carrying capacity and athletic ability, is not worth the risk of the most common side effect. Giving EPO to a horse may result in too many red blood cells, which will make the circulating blood sludge-like and, in turn, causes obstruction of small blood vessels and strokes. Another potential side effect of repeatedly giving EPO to horses is suppression of the horse’s own EPO production, which will result in irreversible anemia.

Under current Ontario Racing Commission (ORC) rules, a horse testing positive for EPO is suspended for 90 days. Also, the trainer for a first offence is subject to a minimum ten year suspension and a \$40,000 fine. However, it is often difficult to directly detect EPO use at the racetrack because the drug remains in the circulation system only briefly.

Dr. Bienzle’s research to combat the problem of blood doping is gaining ground by looking at the possibilities of monitoring hemoglobin concentrations as a way of measuring the effect of EPO use. Research is now going this route because unlike in humans, where abuse of the drug may be detected by measuring young red blood cells produced in the bone marrow (reticulocytes), horses do not release many reticulocytes into blood. Hemoglobin levels, on the other hand, go up in a predictable manner when EPO has been administered. Knowing the “normal” hemoglobin concentrations in racing horses may allow setting permissible limits for hemoglobin concentration in racing. Preliminary data suggests that hemoglobin concentration is not gender specific, but varies between



Photo by: Jackie Bellamy

Dr Bienzle’s research to combat the problem of blood doping is gaining ground by looking at the possibilities of monitoring hemoglobin concentrations as a way of measuring the effect of EPO use.

thoroughbred, quarter horse and standardbred breeds. Data analysis is expected to be complete this fall to determine specific values for each breed.

With over 60 types of EPO available on the market it is difficult to accurately measure each drug variant. Measuring the effects of the drug on allowable hemoglobin concentration specifications should prove valuable in the battle against blood doping. “We want fair racing and a clean horse racing business,” says Bienzle. “Illegal drug use is unsustainable and in the long run will bring down the entire racing industry.”

Dr. Bruce Duncan, ORC, Official Veterinary Supervisor, states, “This research is important because in any athletic endeavor

(human or equine) some individuals will always search for an edge and various forms of blood doping are one of those edges. It behooves us to research new techniques for detecting such illegal activities to keep a level playing field for the owners and to uphold the health and welfare of the horse as paramount. The ORC, with monies garnered from a betting levy, helps fund Equine Guelph research projects, thus benefiting the whole industry.”

Research funding has been provided by Equine Guelph, the Ontario Racing Commission and the Canada Research Chairs program.

-By: Jackie Bellamy

Welcome to another bi-annual report of ground-breaking research funded by partners, sponsors and a growing number of donors to Equine Guelph’s Research Program. This issue brings you news of a long standing battle with R. equi, progress in the fight against doping, advances in 3-D imaging, a white paper on track surfaces, research on weaning stress and embryo freezing, and ends with an update on a unique approach to stem-cell research. The last page has facts on biosecurity and lameness that are of interest to all horse owners. Enjoy and learn.

Dr. Jeff Thomason, co-chair Research Committee

3-D Helping Research Jump Forward

You have seen the marvels of 3-D cinema whether it was Thor's hammer hurling toward you or maybe it was Superman Returns at the IMAX. Ultra sound technology has also developed 3-D capabilities and it is evolving faster than a speeding bullet and with more accuracy than a CAT scan. What this means for researchers is a more detailed picture when making diagnosis and an accurate, simple way to track the results of treatment modalities — potentially without using a more invasive biopsy.

With a recent donation from the Equine Foundation of Canada, University of Guelph researcher, Dr. Heather Chalmers, is able to add a new dimension to her research focusing on early screening of roaring and this may lead to earlier treatment. Roaring, or laryngeal paralysis, is a very common disease which can affect any breed or discipline of horse. This progressive disease results in the inability to open the upper airway during exercise which limits performance and actually leads to a roaring sound. Owners who hear a gurgling sound or an increase in noise when the horse is breathing are encouraged to seek veterinary advice.

The goal of Chalmers' research is to provide horse owners with a reliable, easy, readily available and inexpensive way to screen horses for roaring prior to clinical signs of the disease. This allows horse owners or a potential horse purchaser to plan for their horses career, determining potential or limiting factors. Chalmers was very excited about the donation of new equipment this past summer saying, "When it comes to ultrasound; 3-D allows us to look at the tissues in greater detail to get a more accurate assessment of the size and exact location of abnormalities and to monitor them accurately over time."

Assessing the size of the upper airway muscles helps researchers understand more about their function and disease status. Chalmers explains, "We know from our own experience working out in the gym, a muscle that gets bigger



Photo by: Amanda Hathaway

"The new 3-D ultrasound unit can also be used to monitor and diagnose tendon injuries as shown in this image."

is stronger and more functional. After interventions, the ultra sound will be able to keep track of changes to see if the smaller diseased muscle has responded to treatment by increasing in size."

The next step in Chalmers' research is to solidify the long suspected link between what is seen on the ultrasound screen and what can be found under the microscope if a biopsy were performed. It is important to fully establish: 1) How early disease can be detected in horses? 2) How accurately it can

be done? 3) The rate at which the disease progresses once detected? 3-D ultrasound is helping researchers understand all three of these questions.

Research funding has been provided by Equine Guelph, American College of Veterinary Radiology, Medel Austria, Roberts Imaging Institute at the University of Western Ontario and The Equine Foundation of Canada.

-By: Jackie Bellamy

We Need Your **HELP** to 'HELP Horses for Life'

Equine Guelph has changed its fundraising efforts in order to be more efficient with our administrative costs. The distribution of our donation forms exclusively via our spring and fall newsletter has proven successful and we will continue to use this new cost-effective method of appeal.

"Your donation to Equine Guelph helps fund groundbreaking work that is making a significant difference in the lives of our horses. We truly appreciate your support," Gayle Ecker, director, Equine Guelph.

For donations by phone, please contact: **1-519-824-4120 ext.54431**. Donations to Equine Guelph can also be made online or by mail using credit card (Visa or Mastercard) or cheque. Please make cheques payable to University of Guelph/Equine Guelph. An official tax receipt will be sent for donations (online donations at www.EquineGuelph.ca will receive an immediate e-receipt).

There are many different ways to give: cash gifts, planned giving, gifts-in-kind, hosting a fundraiser, or volunteering your time. Equine Guelph also offers a tribute program, Hoofprints, to honour deceased horses or people. Please visit our new streamlined donations page for more information and learn how your donations will help horses: www.EquineGuelph.ca



Racing Surfaces Internationally Acclaimed

A number of factors affect the performance of a racing or training surface according to the 34-page “Racing Surfaces White Paper” published in June of this year. This international publication is a survey of current understanding on ways to enhance track safety, and is co-authored by an esteemed panel including: Dr. Mick Peterson (University of Maine), Dr. Jeffrey Thomason (University of Guelph), Dr. Lars Roepstorff (Swedish University of Agricultural Science), Dr. C. Wayne McIlwraith (Colorado State University) and Christie Mahaffey-MPhil (University of Maine). Although there is still much research to be done since the formation of the Racing Surfaces Committee at the inaugural Welfare and Safety of the Racehorse Summit in 2006, this publication will benefit trainers, track superintendants and any person in charge of riding surfaces. Details of proper maintenance of surfaces and training guidelines, based on the knowledge gained from the researchers’ findings thus far are now available for download at:

www.grayson-jockeyclub.org/resources/White_Paper_final.pdf

Climate and maintenance are two of the many factors analyzed by the researchers when investigating for the best possible training surface conditions to enhance safety for the horse and rider. The Racing Surfaces White Paper publication will have future applications helping in the design of tracks in terms of banking and cushioning properties for track surfaces in racing and training. U of G co-author, Dr. Jeff Thomason notes, “Horse industry leaders interested in creating an optimum surface to help minimize injuries in the limbs of horses will be interested in following this research.”

Thomason is pleased to be a part of this White Paper publication. It is the most comprehensive scientific body of research on racetracks to date, yet it is just scratching the surface. New questions have been cultivated requiring further investigation. Thomason will continue to be involved in this collaborative research with targeted studies on the effect of racetrack characteristics on the horse-hoof-track interaction.

With so many variables in play, the next steps in research are always short, specific experiments with a narrow focus (e.g., the effect of different height toe grabs or different shoes on the same surface). “It is only by meticulously piecing together the answers of each precise question that you begin to see the big picture,” says Thomason. Studying the influences of forces and loads and the mechanics of loading on the hoof itself is an integral part of Thomason’s research. One method used to measure these forces is by gluing lightweight sensors to a horse’s hooves before it goes out to the training track. These sensors have been used to record two kinds of data: strain and shock.

With so many track surface options (synthetic, dirt or turf), Thomason is often asked which is the best option. The majority of evidence at present suggests the consistency of the surface is more important than the material of which it is made. A well-maintained all-weather track is desirable. The track should be consistent around its entire circumference. Three questions requiring further research are: 1) What is the range of hardness or softness that is not dangerous to the horse? 2) How well does water need to run off a track? 3) Do track surfaces need to have different properties for impact as opposed to sliding?



Research proves good maintenance is an extremely important component for providing consistency and improving safety. Of course, the track has to be well constructed from the start. Regular maintenance includes light harrowing between races to level the hoof prints left on the top layer. Deeper harrowing as required provides a cushion at the top of the surface. One superintendant reported a 30 - 40% reduction in catastrophic fractures at his track after attending a meeting of superintendants in North America and adopting the consistency maintenance program outlined in the White Paper.

Climate also plays a vital and complicated role in determining maintenance. Thomason reminisces, “Where I grew up in England, the climate consisted of ample rain and you heard about the going being sloppy more often than firm or good. This would be a measure of how slippery or firm the track was.” Conversely, California has problems with the surface becoming too dry. Artificial surfaces were designed to give surface consistency. This has not yet

ed Publication Says Consistency is Key



Photo by: David Landry

cing speeds.

been achieved. Even artificial surfaces change their properties throughout the day when the sun comes into effect. In the morning, the surface becomes softer and records indicate the racing times slow down throughout the day showing a very local effect of sunny climate on the track.

Thomason spends much of his time understanding the complexity of how the hoof interacts with the ground — from absorbing the shock of impact to the abrasion of grinding into the surface to how the weight of the horse is distributed.

One excerpt of the Whitepaper states,

As the soil or top layer of the turf compacts, it becomes stiffer and more resistant to further compaction, bringing the hoof to a stop (Thomason and Peterson, 2008). Once the motion of the hoof has been slowed or has stopped, the weight of the horse is dynamically transferred to the hoof and

then to the harder surface material beneath the hoof. This dynamic transfer of the weight of the horse to the hoof is the source of the acceleration, resulting in peak loads which may approach 2.5 times the bodyweight of the horse. The hardness of the track influences how quickly the foot is decelerated and then the stiffness of the track when the load is being applied. This rate of deceleration controls the strain which is transferred to the leg and results in higher peak loads for stiffer surfaces. Repeated loading to the bone can cause micro fractures and catastrophic fractures (Radin et al. 1972).”

Horses and their owners stand to benefit from this research when new information is discovered regarding how to reduce the factors causing injuries on limbs.

Dr. Jeff Thomason’s research has been funded by the Natural Sciences and Engineering Research Council of Canada (NSERC), Equine Guelph and the Grayson Jockey Club.

-By: Jackie Bellamy

What’s the value of research to your horse?

We have always believed in the value of our research program, and from our survey results we know the industry does as well. In our spring 2011 survey of the equine industry in Ontario, 100% of respondents told us that research is important and 90% believe it is necessary for a viable horse industry. This is loud and unequivocal support for the research activities we promote and fund. The message concerning who should fund research gave food for thought — the answers ranked top to bottom were: federal government (agriculture), corporation, provincial government (OMAFRA), racing industry, national associations, provincial associations, wealthy individual donors, smaller individual donations. Given the current fiscal constraints, it is unreasonable to expect the government or its agencies to bear most of the funding burden. The Ontario Equestrian Federation has heard this message and responded with a generous \$10,000 donation this year. Building partnerships among industry associations, commercial ventures, private organizations and donors, and government to fund equine research is a priority. For example, OMAFRA encourages matching funds, and Dr. Katrina Merkies (equine researcher from Kemptville campus) successfully leveraged an industry donation with OMAFRA funding in this year’s research competition. In my visits with government representatives and board meetings of industry associations in the next year, I will be exploring ways in which to optimize the use of research funds, and effective ways to increase the amounts available. But even small donations make a difference, so please don’t hesitate to play an important role in improving the health of the industry and the horses on which it is founded.

-By: Dr. Jeff Thomason

Co-chair, Equine Guelph Research Committee

New Research Project Examines Ways to Reduce Weaning Stress

Exciting new research will begin looking at alternative weaning methods in foals. Dr. Katrina Merkies (Kemptville, APS) and Dr. Derek Haley (U of G Population Medicine) are researching the use of a two-stage weaning strategy already showing positive results in reducing stress and increasing average daily gain in cattle. In Stage one, a physical barrier is used to deny access to the udder while all other forms of social interaction are permitted. In Stage 2, the dam and offspring are physically separated. The researchers will be looking for empirical evidence that alternative weaning strategies may reduce stress which may also be linked to increased risk of disease and subsequent undesirable stereotypic behaviour in horses. This in turn could optimize welfare promoting healthy growth and improved performance and reproduction, encouraging breeders to provide an optimal environment for their broodstock. Funding for this research project is provided by Ontario Ministry of Agriculture, Food and Rural Affairs.

-By: Jackie Bellamy



Photo by: Barbara Sheridan

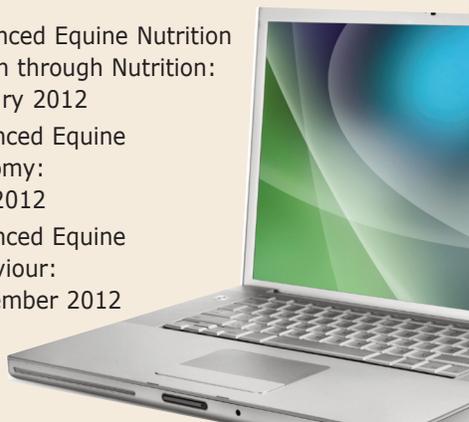
New behaviour study is sure to be a hot topic for horse breeders.



Advanced Equine Course Series:

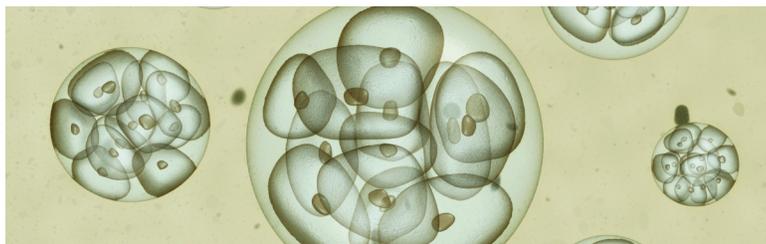
New advanced courses have been created as an opportunity to delve even further into the subject matter outlined in Equine Guelph's award-winning online equine programs. **Next course offerings run January 9th – April 1st, 2012 (early bird deadline Dec. 9th 2011) To view all 18 course offerings and check prerequisites, go to: www.EquineStudiesDiploma.com**

- Advanced Equine Nutrition Health through Nutrition: January 2012
- Advanced Equine Anatomy: May 2012
- Advanced Equine Behaviour: September 2012



2010 Research Project update

Project Preservation Embryo



University of Guelph researcher, Tracey Chenier and her colleagues, continue to benefit from the assistance of internationally renowned cryobiologist, Dr. Stanley Leibo, looking for effective ways to freeze embryos which could lead to world-wide commercial viability of embryo transfer in the horse. Currently, almost all embryo transfers are a costly process involving fresh transfer on the same day. Chenier explains, "The ability to freeze and store horse embryos not only would allow for a more convenient transfer time, but would also prove more cost effective." Researchers were able to study the effects of cryoprotectant on 10 embryos last year followed by 18 this spring. The challenge which is unique to horse embryos, is the formation of a glycoprotein-based capsule (which forms approximately seven days after ovulation) which surrounds the embryo and prevents the freezing chemical from entering the tissue. Chenier states, "We have confirmed that with 9 – 11 day old embryos, very little cryoprotectant can enter into the embryo and very little water can make it out. Water forms ice crystals when you freeze it and this can cause damage to the embryo." Chenier and Leibo will be collecting 40 more embryos to continue working on solving this dilemma.

-By: Jackie Bellamy

Regeneration for the Nations

Canadian-Danish Research Globally Acclaimed

Canadians and Danes were the first to source equine umbilical cord blood for regenerative medicine. The anticipation over the exciting applications of this research were clearly indicated by the massive number of downloads which occurred within two weeks of the first report published back in 2007 — a whopping 3500+! “The long term goal is to find new treatment modalities for diseases and conditions where there currently are no good treatment modalities,” says Dr. Thomas Koch, who researches joint cartilage repair at Aarhus University, Denmark and the University of Guelph. Koch expands on one reason stem cell research is such a hot topic by explaining the concept of a reduced burden on the healthcare system, which could potentially result from curing incurable degenerative diseases.

The successful isolation of cells from equine umbilical cord blood for regenerative purposes has put the U of G on the map as a leader in equine stem cell research. In his latest research, Koch is able to isolate mesenchymal stromal cells (MSCs) for potential cartilage repair using a very simple, non-invasive procedure. Umbilical cord blood is obtained at the time of foaling by clamping the cord and collecting the blood into a transfusion bag. Once at the lab, this blood is then put into a plastic container and then the cells that “love plastic” show their potential for regenerative research. Any unwanted floating cells are easily removed from the container because the desirable MSC cells actually adhere to the plastic and multiply! Koch can then create cartilage from these cells in the lab.

Studies for maintaining cells at the injury site are ongoing. The complication is integrating cell-repaired cartilage with the underlying bone and adjacent normal healthy cartilage. Koch is investigating sophisticated matrices and scaffolds as well as a technique known as mosaic arthroplasty. In mosaic arthroplasty, a number of plugs consisting of both cartilage and bone are placed in the cartilage and bone defect in a cobblestone pattern, hence the name mosaic. Pioneered by Dr. Mark Hurtig from the University of Guelph, this option, although technically difficult, may allow a better integration between cartilage and bone.

Using umbilical cord blood cells to make bone cells and cartilage cells has earned Koch’s research international recognition. The application for bone healing in fracture and cartilage repair is promising. Now researchers are working on better ways of differentiating undifferentiated cells into cartilage cells so there will be enough cells for therapy.

Dr. Thomas Koch is employed by the Orthopedic Research Lab at Aarhus University in Denmark and funded by the Danish Research Agency for Technology, Production and Innovation. Additional operating funds are provided through: Grayson Research Foundation of Lexington, Kentucky; BioE Inc. of Minnesota, USA; SentrX Animal Care Inc. of Utah, USA; Morris Animal Foundation, USA and the Equine Guelph Research Fund.

-By: Jackie Bellamy



Photo by: Studio 404



Cells that “love plastic” show great potential in regenerative research

Get the free mobile app at: <http://gettag.mobi>
Video by: Norse Ridge Farms Limited, King City, ON.

This video can also be viewed under research updates at:
<http://www.equineguelph.ca/research/index.php>

Online Learning Community Coming Soon!

Equine Guelph is developing an online learning community for youth. New interactive learning tools will stress safety, health, welfare and careers in the horse industry. Some of the topics youth will be able to discover online include: caring for horses and functional anatomy.

Gayle Ecker, director of Equine Guelph, thanks Grand River Agricultural Society for enabling this program to get off the ground, “This is the start of a long term program that we believe will have a major impact on youth who are interested in educational opportunities

and a future working with horses.” Thanks to \$15,000 donations from both Grand River Agricultural Society and Russ Willoughby, friend of Equine Guelph, the launch date for this exciting new program is near. Stay tuned to www.EquineGuelph.ca for more details.



What's Your Biosecurity Risk?



Biosecurity is a major concern to all horse facilities – small and large.

You know how to reduce your chances of catching a cold, but how do you rate in keeping your horses safe from infectious disease?

See how you score. Calculate your horse farm's risks with the Equine Biosecurity Risk Calculator, an educational resource of Equine Guelph (University of Guelph) developed in collaboration with Colorado State University and sponsored by the American Association of Equine Practitioners (AAEP) Foundation and Vétuquinol Canada Inc.

The online resource helps horse owners calculate the biosecurity risk on their farms and also provides educational feedback on ways to decrease the risk of infectious disease. So, take 10 minutes and answer 42 questions about your farm at www.EquineGuelph.ca (click on Biosecurity Calculator to calculate your biosecurity risk).

"The online resource will give horse owners a great starting point by revealing the potential risk currently present on their own farm and the most practical ways to decrease those risks," says Dr. Wayne McIlwraith, AAEP Foundation Chairman. "AAEP Foundation is pleased to collaborate with our partners in Canada and the U.S. to provide this valuable tool for horse owners in North America."

Equine Guelph thanks its partners for sponsoring the Equine Biosecurity Risk Calculator.



Is Your Horse Lame?

Equine caregivers know all too well, identifying and treating lameness in horses can be a frustrating and expensive process.

Equine Guelph's new Lameness Lab online tool, sponsored by Pfizer Equine Division, will help you learn about lameness through interactive activities. Discover: the causes, factors contributing to increased risk, the body tissues involved and how to tell if your horse is lame. Test yourself with the Lameness Video Challenge and find out how a veterinarian detects lameness.

"We think that a visual approach to lameness will greatly help horse caregivers better understand the basics of lameness and how to recognize the signs or symptoms in their horse," says Dr. Cathy Rae, equine Technical Services veterinarian for Pfizer Animal Health. "This understanding should help them detect lameness earlier as well as guide them in knowing when to call their veterinarian."

To check out this tool, go to Equine Guelph's 'Toolbox' at www.EquineGuelph.ca and click on Lameness Lab.



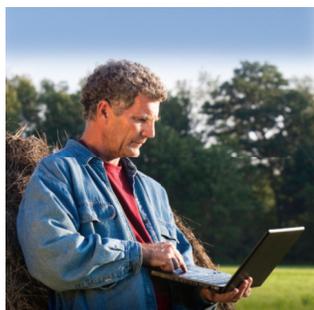
EVENTS

Mark your calendar!

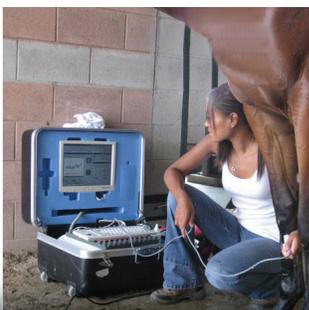
Royal Agricultural Winter Fair (EquiMania!)

November 04 - 13, 2011

Anyone wishing to excerpt Equine Guelph should contact:
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horses@uoguelph.ca



educating horsepeople



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