Kevin Haussler’s newly designed instrument—made of a series of spinal transducers—allows scientists, for the first time, to measure the motion of individual back joints in the live horse.

New Instrument Helps Diagnose Back Pain

Just as in humans, back pain is a common and significant problem among performance horses. Although back problems in horses have been identified as a significant cause of chronic poor performance, they are still poorly understood and therefore not recognized and treated as well as they might be.

“Back problems are often overlooked during lameness evaluations because veterinarians don’t have objective measures to assess spinal dysfunction,” says Kevin Haussler DVM, DC, PhD, a lecturer in biomedical sciences.
Back Pain
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“We also have very little information about how a spinal dysfunction might affect locomotion.”

Haussler says that veterinarians often have a difficult time identifying exactly where a back problem is and what caused it. As a result, most veterinarians try to relieve stiff, painful backs or muscle spasms with rest or medication, without actually addressing the cause of the injury.

Meanwhile, researchers are beginning to recognize just how prevalent the back problems might be. In a survey of 36 Thoroughbred racehorses that died of unrelated injuries, Haussler found that every horse had evidence of spinal pathology.

To better understand the effects of muscle and joint injuries on the equine back, Haussler will use a new Zweig grant to improve an instrument he helped to develop that can assess back motion. He plans to use the instrument in 10 horses to determine how the back responds to specific types of muscle and joint pain.

The grant will allow Haussler to improve upon a measuring device, which has six different gauges that measure changes in back motion. The instrument is capable of measuring three-dimensional movements: two gauges assess flexion-extension, two others measure lateral bending, and the third set evaluates axial rotation. The measuring device was used successfully in three horses in a prior study to measure the amount of back motion. Haussler will attach the instrument with surgical screws that will be temporarily and superficially placed in the vertebrae of the back. The horses will be sedated and medicated during the surgical procedures.

In the first phase of the study, launched in May, spinal movements were measured while the horses were standing (for a baseline), walking, trotting, and cantering on a treadmill. In the second phase of the study, Haussler will induce temporary back muscle pain or joint discomfort to simulate joint pain associated with arthritis; he will then look at the effects of muscular and articular (joint) pain on spinal motion and the functional mechanisms of acute back pain in horses.

“Back problems are often overlooked during lameness evaluations because veterinarians don’t have objective measures to assess spinal dysfunction.”

Kevin Haussler

“The induced back pain, which the horses should recover from within 10 to 15 minutes, will allow us to see how back motion changes with muscle and joint discomfort. We expect to measure reduced muscle activity and restricted back motion,” Haussler explains.

To simulate the back problems, he will inject a saline solution that makes the muscles in the area temporarily spasm or abnormally tense. In one group of horses, the solution will be injected into the superficial back muscles to simulate a muscle injury. These back muscles extend between the vertebrae in the thoracic and lumbar regions and aid in the support and extension of the back. In the remaining horses, the injection will be made into the deeper back muscles near the joints to simulate an articular injury.

The amount and patterns of back motion will be compared before and immediately after the back injections. Such injections have been used before in humans to similarly measure the short-term effects of induced back muscle pain. Haussler and his collaborators will repeat the treatment and measure spinal motion one week later to evaluate the longer-term effects of the back pain on back movements.

“We suspect that the back pain will alter normal back and leg motion and that the superficial muscle pain will produce different changes compared to the deeper joint pain,” Haussler explains.

The long-term goal of the project is not only to better understand the causes of equine back problems and their effects on locomotion and performance, but also to develop ways to objectively evaluate treatments for back problems. These might include the use of anti-inflammatory medications, muscle relaxants, physiotherapy, chiropractic, and even acupuncture modalities.
First Steps Toward a Vaccine Against Leptospirosis

Leptospirosis, a disease that infects humans and animals, including horses, is caused by a highly invasive spiral bacteria. In horses, leptospirosis can cause partial or total blindness, abortion, fever, and icterus (jaundice). Although there are vaccines to protect cattle, swine, and dogs that live in infected areas, there are no available vaccines approved specifically for the horse.

To lay the groundwork for a vaccine against equine leptospirosis, Yung-Fu Chang DVM, MS, PhD, Dipl ACVM, a professor of population medicine and diagnostic sciences, has received a Zweig grant to clone and characterize the genes that encode the candidate vaccine antigens.

"Most veterinarians currently use commercially available vaccines approved for cattle in horses, but these vaccines produce only incomplete, short-term immunity," says Chang. "Our long-term goal is to develop a genetic (DNA) vaccine or a recombinant vaccine against equine leptospirosis which we believe has the potential to protect against the disease without many of the disadvantages associated with vaccines presently used. Such a vaccine would involve inoculation with plasmid DNA vectors that encode immunogenetic proteins; these proteins induce both antibody and cell-mediated immune responses that provide protective immunity."

Specifically, Chang will clone and characterize the outer surface proteins (lipoproteins) of *Leptospira interrogans* serovar pomona type Kennewicki, which are protective immunogens and could be used to develop a leptospiral vaccine.

Although little is currently known about the surface proteins of the pathogenic bacterium associated with leptospirosis in horses, Chang says that researchers know that outer surface proteins that interact with hosts are of interest as vaccine candidates because they’ve been shown to be protective immunogens of bacterial diseases. In previous work, Chang has examined the outer surface protein A (OspA), a lipoprotein from another spirochete, as a DNA vaccine in mice and dogs and has studied a recombinant OspA vaccine in dogs and horses.

“We have shown that OspA can protect dogs and horses against Lyme disease and *L. interrogans* serovar pomona, a spirochete that expresses lipoproteins,” Chang explains. “In fact, the OspA protective antigen is itself a lipoprotein. Thus, it is reasonable to speculate that one or several of the outer surface proteins of *Leptospira* would also be immunogenic and, therefore, be potential candidates for vaccine development.”

Researchers have identified a specific protein that is an immunogenic antigen in animals experimentally infected with *L. interrogans* serovar pomona, which is why Chang has chosen to focus on the cloning and characterization of its lipoprotein gene as the first step in the development of a DNA and/or recombinant vaccine. Since he knows that certain antibodies generated from infection in *L. interrogans* serovar pomona in horses cross react with the eye, he must keep in mind that any effective genetic vaccine must be derived from antigens that are not cross-reactive with the eye.

“We plan to identify these antigens by molecular genetic techniques,” he says.

Developing an equine vaccine against leptospirosis is critical because the disease has such wide-ranging effects.

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The pathogen is known to cause uveitis (a potentially devastating inflammation of the internal structures of the eye, also known as periodic ophthalmia or moon blindness), corneal opacity, abortion, fever, and jaundice both in experimentally infected and naturally infected horses. It is also believed to be the cause of some cases of still births, decreased milk production, kidney failure, and even death in horses. In addition to recent outbreaks of the disease among horses in New York, Pennsylvania, and Kentucky, researchers have recently identified an increase in confirmed leptospiral abortion cases among horses, and one researcher has even shown that leptospiral placentitis is one of the most important emerging causes of equine abortion.

“It is clear that equine leptospirosis is becoming more and more of a problem because vaccination with the leptospiral vaccine for cattle has generally been ineffective,” Chang points out.

Horses can contract leptospirosis by drinking water that has been infected or eating hay or grain that has been contaminated by the urine of infected horses, cattle, swine, or wildlife including skunks, rats, raccoons, foxes, opossums, and deer. The organism enters either through direct contact with blood, urine, or tissues from infected animals or through the mucous membranes of the eyes, nose, and mouth or a cut in the skin.

Until a vaccine is available, horse owners can protect their animals by preventing them from drinking stagnant water and by practicing good management of manure. Both water and manure can harbor the spirochete. Other precautions include fencing in water sources to keep wildlife out, draining wet muddy areas where horses are pastured, and disinfesting any areas where infected animals may have been.

Agriculture & New York State Horse Breeding Development Fund

In 1965, the Agriculture and New York State Horse Breeding Development Fund was established under the LaVerne Law as a public benefit corporation to promote agriculture and the breeding of Standardbred horses. In addition, it encourages and funds equine research in New York State.

The fund fulfills its mission by distributing the money it receives (more than $7 million in 1998) from the raceways, Off-Track Betting corporations, and horse owners' contributions to a wide variety of programs. The largest chunk, some $6 million in 1998, goes to purses for New York—bred Standardbred races.

“Although our Sire Stakes Program confers riches and glamour on a number of horses and owners each year, New York's program was never meant to be the exclusive province of the blue-blooded horse or the major breeder and owner,” says Charlie Knauss, Jr., executive director of the fund since 1971. “The fund is designed, and has been carefully nurtured, to provide competition and rewards for horses, breeders, and owners at every level of the sport.”

Unlike other states, the Empire State program provides racing opportunities not only for the top and bottom levels of competition, but for the “modestly bred youngster” that turns out to be a surprisingly good racer. “There are also opportunities for the colt or filly who is late to develop, or simply never reaches the heights expected of him or her,” Knauss adds. Each year, the fund also distributes 2 percent of its total annual revenue to the Harry M. Zweig Memorial Fund; this component represented almost $140,000 for equine research at Cornell in 1998. Specifically, the fund provides money for the following:

- **Sire Stake Races at the Pari-mutuel Tracks:** In these races, two- and three-year-olds vie throughout the state and the top-performing qualifiers compete for the $150,000 Championship Races in all regular divisions at the end of the season at the New York Night of Champions.
- **State Fair Racing at Syracuse:** The best of state-bred horses compete in the mile-long races and the best of the best race in the Empire Pace and Harry M. Zweig Memorial Trot.
- **Late Closing Events for Sire Stakes Eligibles:** This series is designed for “late-blooming” two- and three-year-olds that are nominated late when their potential becomes more obvious. They compete in a series of $6,000 legs, and the leading point earners go on to finals worth $15,000 to $20,000.
- **County Fair Racing:** Here, horses race in non-pari-mutuel racing at more than 25 agricultural fairs throughout New York. Top performers in each age group and gait compete in championship races at various pari-mutuel tracks throughout the state. In 1998, these fairs received $175,000 from the fund for maintenance and repair programs and almost $349,600 in purses for the County Fair Division of the Sire Stakes Program. The New York State Fair in Syracuse also received $75,000 from the fund for maintenance and construction.
- **Broad-based Support:** The fund also contributes money to county agricultural societies for maintenance and repair of racing facilities and to the 4-H program for career education in breeding and racing, in Morrisville, N.Y. A major initiative in this area is the three-week-long Standardbred Management and Driving School programs at the State University Agricultural & Technical College at Morrisville. Each session hosts 25 youth who learn topics ranging from harnessing and jogging horses to horse anatomy, conformation, health, and breeding. Support from this area also goes to the Zweig fund.
Committee Member Profile

Philip Trowbridge

Animal husbandry is in Philip Trowbridge’s blood. A third-generation farmer, Trowbridge, the newest member of the Zweig committee, always knew he’d get a job in animal science. The eighth of nine children, he grew up on the family farm with cattle, horses, and vegetables, then majored in animal science at the State University of New York College of Technology at Alfred (Alfred State College). The day after he graduated in 1976, Trowbridge went to work for Gallagher’s Stud, Inc., a 600-acre farm in Ghent, N.Y., about 30 miles south of Albany. He’s worked there ever since.

Trowbridge started as a herdsman for the farm’s Angus operation. A year later he married his college sweetheart. A year after that the farm’s owners, Mr. and Mrs. Jerome Brody, purchased their first Thoroughbred horses. Soon after, the farm’s Thoroughbred horse breeding operations became successful and Trowbridge was named manager. Today, the farm has horses racing throughout the nation and all over the world.

“I’m very interested in Zweig because Cornell’s College of Veterinary Medicine does so much for the Thoroughbred industry, and I want to understand it a bit better and add whatever I can to its efforts to help the industry.”

Philip Trowbridge

Gallagher’s Stud, a 400-acre farm outside of Albany, and its animals have been Trowbridge’s passion since he graduated from college.

“In fact, we bred the two highest-priced New York—bred Thoroughbreds,” Trowbridge says.

In addition to managing the breeding and marketing operation for the 55 horses the farm owns and the dozen or so horses it sells each year, Trowbridge oversees herds of his own. With his wife, Anne, and their two teenage children, Trowbridge manages two Belgium draft horses, which the family drives around the farm, 75 Angus cattle (with sales of about 40 offspring a year), 30 sheep (with sales of about 30 sheep a year, mostly to 4-H youth), 20 chickens for the family’s egg supply, and two Border collies. The Trowbridges have been breeding Border collies for about 20 years. The farm and its animals are Trowbridge’s passion.

“I don’t do anything else,” says the 43-year-old agriculturist.

“I don’t have any other hobbies or interests. For me, I really really truly love what I am doing and don’t want to do anything but this.”

Trowbridge came to the Zweig Committee in August of last year as a representative from the Board of Directors of the New York State Thoroughbred Breeding & Development Fund.

“I’m very interested in Zweig because Cornell’s College of Veterinary Medicine does so much for the Thoroughbred industry, and I want to understand it a bit better and add whatever I can to its efforts to help the industry,” Trowbridge explains.

A long-time advocate of youth development in agriculture, Trowbridge started an intern program at Gallagher’s Stud almost 20 years ago and continues to offer it every semester.

“We like to give college and high school students the opportunity to complement what they’ve learned in classes with working on the practical end of the business regarding daily care of horses,” Trowbridge explains. “We take two students a semester and it has become very competitive.”

Formerly on the board of the New York Thoroughbred Breeders, Trowbridge now focuses his time on the New York State Thoroughbred Breeding & Development Fund, as well as serving on the boards of the Columbia County Agriculture Society, Columbia County Cooperative Extension, the All American Angus Futurity, and the Columbia County 4-H.
The Harry M. Zweig Memorial Fund for Equine Research honors the late Dr. Harry M. Zweig, a distinguished veterinarian, and his numerous contributions to the state’s equine industry. In 1979, by amendment to the pari-mutuel revenue laws, the New York State legislature created the Harry M. Zweig Memorial Fund to promote equine research at the College of Veterinary Medicine, Cornell University. The Harry M. Zweig Committee is established for the purpose of administering the fund and is composed of individuals in specified state agencies and equine industry positions and others who represent equine breeders, owners, trainers, and veterinarians.

2000 Harry M. Zweig Memorial Fund Committee

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Bruce Hamilton
Executive Secretary, Harness Horse Breeders of New York State
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Mike Hoblock
Chairman, NYS Racing and Wagering Board, Albany, NY

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