



Zweig Memorial Fund News Capsule

*A Report on Equine Research
at the College of Veterinary Medicine
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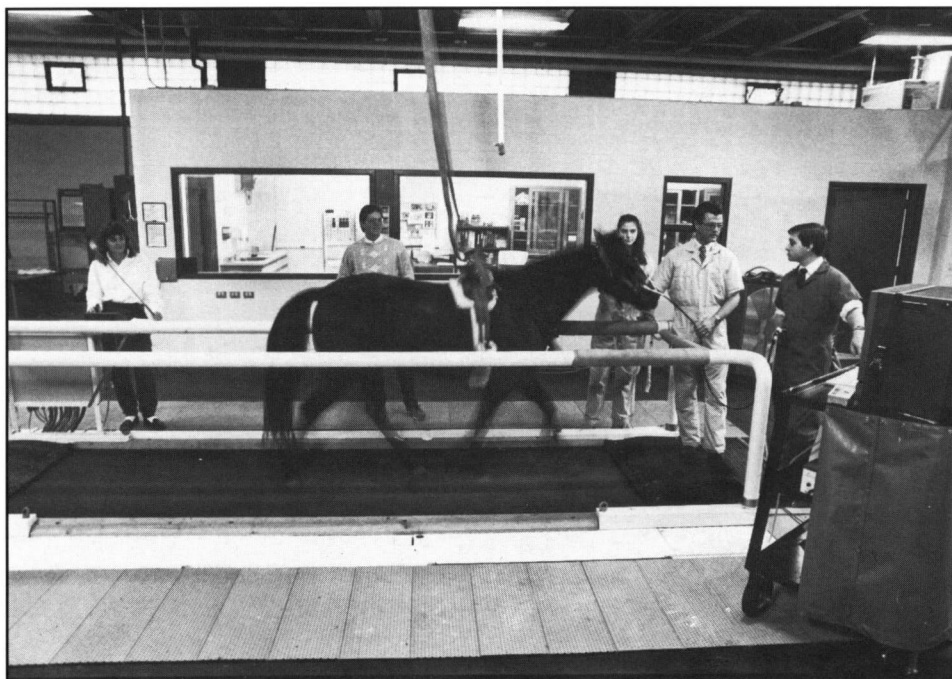
Ceremony Opens Equine Performance Testing Clinic

On November 8 friends and supporters of the College of Veterinary Medicine at Cornell gathered for a ribbon-cutting ceremony marking the official opening of the Equine Performance Testing Clinic. Many people have been instrumental in the realization of the clinic, and the hard work and planning stretch back over the last eighteen months.

In that time equipment has been added to the clinic and the facilities have gradually been renovated. The first step was the acquisition and installation of a high-speed treadmill. Next sophisticated computer hardware and software and specialized diagnostic instruments were added. The result was the first unit of the clinic, the Respiratory Function Testing Unit.

The Equine Performance Testing Clinic will soon introduce the Clinic's second and latest unit - the Lameness & Gait Analysis Unit. Instrumentation for the unit will be operational in early 1990. Veterinary surgeons working in the unit will first analyze normal motion in the horse and later, as data are accumulated and expertise develops, will analyze difficult lamenesses.

The opening of the third and final unit of the clinic, the Fitness and Performance Testing Unit, is scheduled for the near future. The unit will be designed for the evaluation of levels of fitness in horses in training and the assessment of



At the heart of the Equine Performance Testing Clinic is its high-speed treadmill. Dr. Renata Rehder (far left) controls the treadmill's speed, while Dr. Richard Hackett (at the horse's head) and Dr. Norm Ducharme (far right) use an endoscope to evaluate respiratory function.

performance potential of young, untrained horses.

The College thanks all the people and organizations who have made the Equine Performance Testing Clinic possible, including the alumni of the College of Veterinary Medicine at Cornell, the Mrs. Cheever Porter Foundation, the Harry M. Zweig Memorial Fund, and the Finger Lakes Division of the Horsemen's Benevolent and Protective Association. The New York Division of the Horsemen's Benevolent and Protective Association has provided generous support to staff and equip the Respiratory Function Testing Unit.

Treadmill is Centerpiece of Equine Performance Testing Clinic

by Susan S. Lang

In the old days, when veterinarians needed to monitor the lung and heart function of an exercising horse, they hitched the animal to a harness racing cart. Not only was the cart loaded down with instruments—including a car battery and a converter wired to the electrical monitors—it also had to haul a veterinarian or two around the dusty gravel track. Often it took an entire day to test one horse. Sometimes the weather interfered at the most inconvenient times.

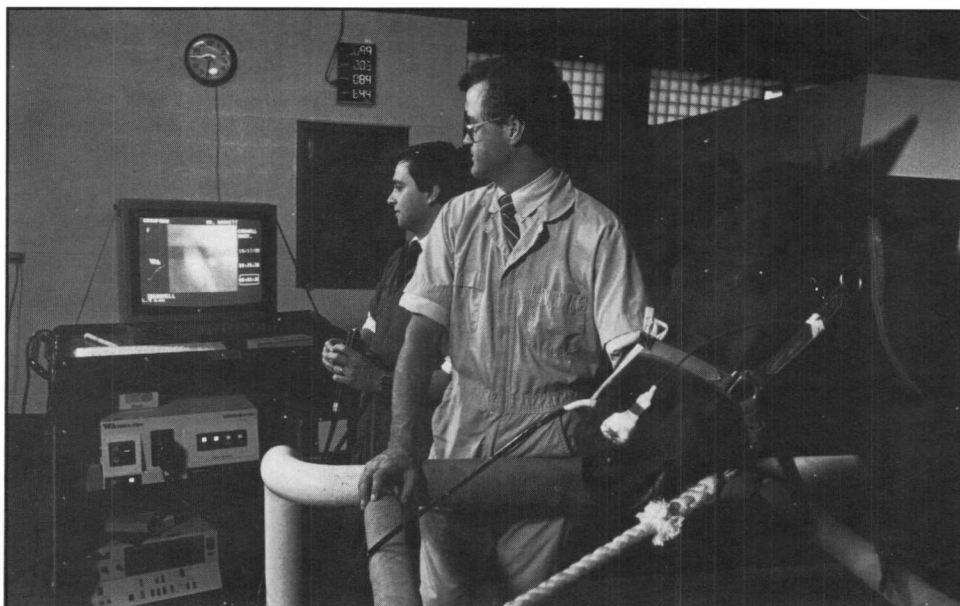
Fortunately those cumbersome days are long gone and the harness racing cart has been replaced by the high-speed treadmill now operating at the Equine Performance Testing Clinic at the College of Veterinary Medicine at Cornell. "With the Respiratory Function Testing Unit now officially open, we can offer state-of-the-art technology and expertise in evaluating, diagnosing, and improving the athletic performance of horses," says Dr. Donald Smith, chairman of the Department of Clinical Sciences.

The Swedish SATO treadmill allows daily workouts of horses regardless of season or weather. Capable of going up to thirty-five miles per hour and tilting to a 10 percent slope, the treadmill allows veterinarians to assess many conditions in the horse's upper and lower airways.

"We can now reach and monitor the equivalent of peak performance in an exercising horse under controlled conditions," says Dr. Richard P. Hackett, head of Cornell's Large Animal Clinic and director of the Respiratory Function Testing Unit. "Also there's little likelihood of causing a lameness or injury when testing the horse."

So far the treadmill has been used to assess more than 150 horses, primarily thoroughbred and standardbred racehorses, although hunters and jumpers and even draft horses have been evaluated on the treadmill.

Using this new technology, veterinarians will be able to evaluate much more thoroughly, for example, whether loud breathing noises ("roaring," or laryngeal hemiplegia), bronchitis, or bleeding



Drs. Hackett and Ducharme study laryngeal movement on the video monitor as the horse exercises on the treadmill.

(exercise-induced pulmonary hemorrhage, or EIPH) in an exercising horse affects performance. The Respiratory Function Testing Unit also enables researchers to evaluate such airway problems as palate displacement, epiglottal entrapment, and pharyngeal collapse.

The Flowmeter

A unique aspect of the new Respiratory Function Testing Unit is its ability to measure airflow accurately without interference or added resistance. The key piece of equipment is a highly sophisticated flowmeter designed for Cornell's equine researchers. Made from light-weight aluminum and weighing only about two pounds (compared with the old-fashioned flowmeters, which weighed fifteen pounds), the flowmeter is the only one of its kind capable of accurately measuring the massive peak respiratory flows generated by exercising horses.

Resembling a mask the size of a football, the flowmeter is placed over the horse's nose. Tubes are screwed into the nostril openings of the mask, and embedded crystals send a signal back and forth to measure the airflow volume in and out

of each nostril. In addition, pressure sensors can monitor the pressure at the nostrils, pharynx, trachea, and thoracic cavity. By using the flowmeter and pressure monitors on horses at rest and in motion, researchers can measure the rate, pressure, and ventilatory volume of air going in and out of the horse, the compliance of the lungs (how stiff or pliant they are), airway resistances, and the work of breathing.

The Endoscope

For evaluation of problems in the upper airway, an endoscope — a two-meter-long tube about as thick as a man's finger that encases a light and three tiny video cameras for recording red, blue, and green — is guided through the nostril to the larynx. The instrument videotapes the movements of the larynx not only while the horse is resting but as it is exercised up to a gallop. The signal of a thermistor, a heat-sensitive instrument that is clipped onto the other nostril, is also videorecorded to indicate the temperature of the air the horse is expiring and inspiring. The videotape is later replayed in slow motion, or even frame by frame, for precise evaluation. Researchers also use a novel computer program to trace and measure the

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Writer: Susan Lang

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dimensions of the airway. The information thus obtained allows them to assess and classify the severity of the abnormality.

The Computer

The highly sophisticated instruments in the Respiratory Function Testing Unit monitor essential respiratory and cardiovascular functions, producing data that are collected, recorded, and analyzed by the computer. To interface the data from the treadmill, the flowmeter, the pressure sensors, and other equipment with the computer, bioengineer Gary Neilan came on board about a year ago. He ensures that the readings from the various instruments are accurately recorded to the computer.

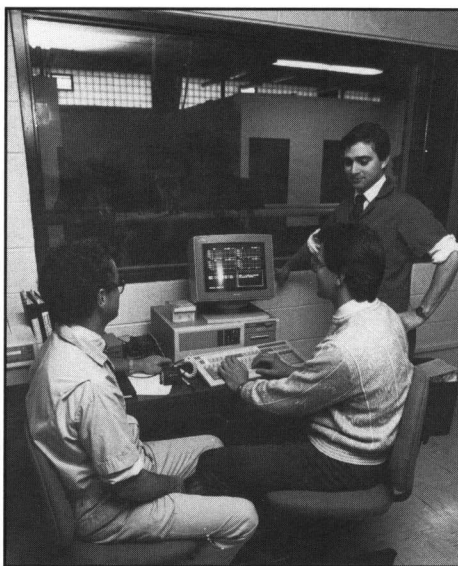
"My goal is also to write an easy-to-use software program that any veterinarian or technician can use while working horses out on the treadmill," explains Neilan. So far, Neilan's system allows researchers to use the computer to monitor pulmonary and systemic artery pressure, left- and right-nostril airflows, and translaryngeal pressure at the same time.

Soon Neilan will add measurements of hoof pressure to the information fed into the computer. Several high-speed cameras and a sophisticated computer system that analyzes motion while horses run on the treadmill will also be used for the new Lameness and Gait Analysis Unit. Opening early in 1990, the new unit will be used to diagnose and study lameness, assess surgical therapy, and evaluate the effects that factors such as track conditions and shoeing have on gait.

Research Projects

In addition to assessing performance horses, the treadmill is considered essential by some Cornell equine scientists for various research projects.

Dr. Harold Hintz, professor of animal nutrition, for example, used the



Gary Neilan (photo center) shows Dr. Hackett (seated left) and Dr. Norm Ducharme (right) the latest test data as recorded by the software program he developed.

treadmill to study whether the vitamin E requirements of exercising horses should be boosted to help protect against tissue damage from free radicals produced during exercise.

Hintz has also been exercising draft horses on the treadmill to simulate the working equivalent of plowing. By measuring lactic acid levels and heart rates, he hopes to determine how fit the

horses become over a working season and to compare the draft horses with standardbreds.

Dr. Normand Ducharme, associate professor of surgery, uses the treadmill to test horses that have had phrenic nerve transplants. Ducharme believes that such transplants will best repair a partially paralyzed larynx that causes "roaring" in horses.

Dr. Robin Gleed, associate professor of veterinary anesthesiology, works horses out on the treadmill to study the source of pulmonary bleeding, or EIPH, a condition that plagues up to 75 percent of athletic horses. Using a special flow probe that is surgically installed, Gleed observes how the blood flow in the bronchial artery varies during exercise. He suspects that the bronchial artery is at the root of EIPH.

The generous support of the Harry M. Zweig Memorial Fund assisted in the construction of the Equine Performance Testing Clinic. The Respiratory Function Testing Unit was made possible through the New York Division of the Horsemen's Benevolent and Protective Association.

Gait Analysis Instrumentation Added to Clinic Capabilities

A computerized, automated, 3-dimensional video gait analysis system will soon be added to the extensive facilities in the Equine Performance Testing Clinic. The system is designed to work with the Clinic's high-speed treadmill in the study of motion in horses. College alumni and the Harry M. Zweig Memorial Fund for Equine Research contributed substantially toward the purchase of the \$135,000 system.

According to Dr. Alan Nixon, a large animal surgeon in the Teaching Hospital, the video system is capable of automatically and simultaneously tracking thirty points on a horse in 3-dimensional space. The system's ability to provide data on a horse's movement in three-dimensions means that information on foot and joint displacements, angles, velocities, and accelerations is now available. Said Nixon, "This system uses four video cameras and up to thirty reflective markers on the horse's feet, fetlocks, carpi, elbows and shoulders to plot the movement in space of individual joints. Also, by comparing the movement of three markers—say for example the elbow, the carpus and the fetlock—you can determine the range, velocity and acceleration of the carpus flexing in space."

THE RESPIRATORY TESTING UNIT IN ACTION

A Case Study: Jumping Jack Flash

Jumping Jack was a 1,570 pound, six-year-old gelding that was brought to the Respiratory Function Testing Unit by its Long Island owner several months ago.

"The owner had purchased Jumping Jack four months before bringing him in, and he wanted to use the gelding as a hunter," explains Dr. Richard P. Hackett, director of the unit. "But whenever the horse was exercised, he made a loud noise and seemed to tire earlier than he should have." To assess Jumping Jack, Hackett fitted the horse with a heart rate monitor, inserted the endoscope, and attached the thermistor. While the horse was at rest, Hackett videotaped the appearance of the larynx and pharynx. He then put Jumping Jack on the treadmill and attached a safety

strap to his girth that would automatically stop the treadmill if he tripped.

The treadmill was turned on and the horse started running on it. A digital instrument on the wall monitored the time elapsed, the distance run, the tempo of the horse's gait, and the speed and slope of the treadmill. The treadmill was tilted five percent and the horse was exercised for eight minutes, reaching a maximum speed of about twenty-three miles per hour.

While the horse was being exercised, the video endoscope recorded Jumping Jack's larynx in action. The researchers later analyzed the videotape, took various measurements of the larynx, and integrated the other data they had accumulated on the horse at rest and during exercise.

"We confirmed that the horse's larynx was partially paralyzed on the left side," explains Hackett, "and that the problem was severe enough to account for the noise the horse was making. The critical finding, however, was that the normal

surgical procedure used to ameliorate the condition—tying back the paralyzed side of the larynx—would not help this horse for a variety of reasons. Only an endoscopic examination of the horse during exercise could have determined that."

As a result, the veterinarian recommended a far less common treatment for roaring: a sacculotomy and a partial vocal cordectomy. "Before the days of the treadmill we probably would have sent the horse home or done the standard tie-back procedure," says Hackett. "In other words, we probably would not have helped this horse."

The follow-up examination of the horse six weeks after surgery showed that he had a substantially larger laryngeal opening. Hackett is optimistic that the horse will be greatly improved when he returns to the hunt field this fall.

By New York State legislation, the Harry M. Zweig Memorial Fund for Equine Research is administered by a committee whose members are individuals in specified government and equine industry positions and others who represent equine breeders, owners, trainers and veterinarians. Current committee members are Daniel J. Burke, Longford Farm; Donald G. Butcher, former Commissioner of the New York State Department of Agriculture and Markets; Dr. Wendall Cooper, Lana Lobell Farms, Inc.; Richard Corbisiero, Jr., Chairman, New York State Racing and Wagering Board; Daniel Gernatt, Collins, New York; John L. Hardy, Tucker and Hardy Associates; Charles Knauss, Jr., Executive Director, Agriculture and New York State Horse Breeding Development Fund; Albert W. Miller, DVM; Everett Schoenborn, Climax, New York; William H. Welch, Executive Administrator, New York State Thoroughbred Breeding and Development Fund; Theodore J. Zornow, Avon Farms; Anna Zweig, widow of Dr. Zweig; and Robert D. Phemister, Dean of the College of Veterinary Medicine, Cornell University, and chairman of the Committee. The Zweig Fund receives two percent of all monies accruing to the Agriculture and New York State Horse Breeding Development Fund and the New York State Thoroughbred Breeding and Development Fund from the state's tracks and off-track betting.

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College of Veterinary Medicine
Cornell University
Ithaca, NY 14853