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IN THIS ISSUE

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College of Agriculture
Department of Veterinary Science

LLOYD'S

COMMENTARY

Testing for equine infectious anemia (EIA) has reduced significantly the risk of acquiring EIA in the United States. In some states, a high level of testing has essentially eradicated EIA from the tested population. Of the 179,000 equids tested in the northeastern United States in 1998 only 3 were found positive. At $25 per test, that's about $4,500,000 to find 3 virus carriers. What is the collective benefit/cost ratio? Is the testing reducing the risk of acquiring EIA? Perhaps this should be reviewed with industry and new recommendations considered for continued effective control of EIA in the northeastern states.

By contrast, in many areas of the United States the majority of equids has not and probably will not be tested until area-wide testing is encouraged or required. For example, the National Animal Health Monitoring System (NAHMS) equine study conducted in 1998 indicates that 58% of horse owners in the central states "have not heard about EIA" and only 12% of resident equids in the western states are tested annually. When EIA is found in these "undertested" areas, it may have been spreading in the population for years. A good example of this may be the focus of infection found in free-roaming horses in Utah in 1998. The equid population can be protected from the risk of EIA if we know where the reservoirs exist. There is an estimated million-fold greater risk of acquiring EIA by commingling with untested horses than by being maintained $\geq$ 200 yards from quarantined test-positive inapparent carriers in areas of the country where the infection is expected in 1 of 10,000 horses.

Several states have recently adopted regulations or legislation requiring annual tests or mandatory testing of equids in contact with test-positive equids (generally defined as within 200 yards). Regulations in Louisiana, for example, require permanent identification and an annual test on every equine. Despite these regulations, passed in 1993, only about 30% of the estimated population is tested each year. More effective strategies to identify and further control/reduce the reservoir of virus must be employed.

The development, application and use of horse-side tests can and should be encouraged in practical area-wide programs that are sponsored and supported by veterinarians and coordinated with owners. Negative test results, obtained while the attending veterinarian is present, could expedite issuing health certificates, if appropriate. If the test results are positive, the representative of the state veterinarian could issue a temporary quarantine, which would become permanent after receipt of confirming Coggins test-results, or removed in the unlikely event that the battery of field test results proved to be inaccurate.

The Infectious Diseases of Horses Committee of the United States Animal Health Association set the framework for effective area-wide control of EIA in the early 1970s. In 1997, the USDA promulgated Uniform Methods and Rules for the control of EIA. Perhaps it is time for a more vigorous and effective application of those principles, especially in the areas of greatest risk.

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INTERNATIONAL

Third Quarter 1998

The International Collating Center, Newmarket provided the following information.

Eleven cases of Contagious Equine Metritis (CEM) were reported from Japan during the first 6 months of 1998. In September CEM was diagnosed in a test mare that had covered a recently imported Dutch Warmblood stallion during the quarantine phase following importation to the United States.

An equine viral arteritis (EVA) "shedding" Warmblood stallion was reported in the United Kingdom in October. Equine influenza was diagnosed widely in France based on serological examination. The paralytic form of equine herpesvirus (EHV-1) was reported from Tuscany in Italy on 4 premises involving 20 horses, 4 of which died. *Salmonella typhimurium* was isolated from horses on several premises in Ireland.

Multiple outbreaks of strangles were reported in racing stables and farms in South Africa. The outbreaks were stated to have originated following the release of imported horses from quarantine in July. Strangles was also reported from Australia, Ireland, Sweden, Switzerland and United Kingdom.

Vesicular stomatitis continued to be reported from the western United States. As of the first week of November the USDA had reported 15 positive premises in Arizona, 101 in Colorado, 12 in Mexico and 1 in Texas. Only one new positive premise, in Colorado, was reported during the first week of November. All reported premises except one in Colorado have involved equine cases.

What is DNA Vaccination?

Vaccines for protection of humans or animals from disease have conventionally been of a few kind: killed organism vaccines like equine influenza vaccine; attenuated live organism vaccines like smallpox vaccine; or subunit vaccines like tetanus toxoid. All are designed to expose the body's immune system to novel proteins that are characteristic of those pathogens: proteins that are either parts of the killed organism, are manufactured inside the body by the attenuated live organism, or are industrially manufactured in the case of subunit vaccines. Following administration the animal's immune system recognizes these proteins as "foreign," triggering development of immune T and B cells, which clear the proteins from the body.

Today a new vaccine technology is being developed that may revolutionize the vaccine industry. The basis of this technology, DNA vaccination, is the accidental discovery that DNA itself, which is not a protein and is not recognized by the immune system as foreign, can be used to vaccinate an animal.

A fundamental tenet of biology is that DNA, the molecule of genetic information, codes for the proteins that are the realization of genetic information. There are DNA "codes" or sequences for all the proteins that constitute infectious agents like bacteria or viruses. If a DNA molecule of the correct sequence is taken up by a cell, the cell makes the protein encoded by the strange DNA, almost as though it were the cell's own DNA. The immune system won't be fooled and will respond to the strange protein by making the required T and B cells. The animal will become immune.

DNA vaccines offer several potential advantages over conventional vaccines:

- They ought to be safe, because DNA is not infectious and can be highly purified. Concerns that DNA vaccines might induce autoimmune reactions or anti-DNA antibodies have so far proven unfounded.
- DNA is stable at room temperature or even tropical temperatures, so vaccine shelf life is enhanced and refrigeration unnecessary; an important consideration for use in Third World countries. By contrast the "cold chain" of refrigeration from manufacturer to recipient, required by conventional vaccines, decreases their utility and adds tremendously to their costs.
- DNA is easy to work with, so new modifications can be quickly developed. This is particularly advantageous for vaccines that need periodic updating, like those for influenza. It also promises to cut down the time needed to develop vaccines against newly emerging diseases.
- Because DNA vaccination produces foreign proteins in the cells of the recipient similar to an infection, the immune response to DNA vaccines is a better imitation of the response to natural infection as compared to the response of killed vaccines.
- The kind of immune response the body produces to DNA vaccine can be biased in the direction most favorable for disease protection by adding to the vaccine genes coding for natural immune modulators, called cytokines. A variety of equine cytokines have been discovered and their effects on the immune system are being unraveled.

Equine Disease Quarterly

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• Lastly, the ease and versatility of genetic technology promises to cut the costs of vaccine production.

Some problems still remain. Foremost is determining the best way to administer DNA vaccines. When delivered inappropriately or at insufficient doses, their effects can be undetectable by standard serological tests, leaving researchers in doubt whether the vaccine is working. Different chemical "facilitators" such as bupivacaine are being studied for their ability to promote the uptake of the DNA into cells. Intramuscular injections have been used, but newer approaches deliver DNA to mucosal tissues such as the inside of the mouth.

A device called the "gene gun" has been used to fire microscopic pellets of gold, coated with DNA, into the skin as a kind of diffuse cutaneous inoculation. Whether this becomes practical remains to be seen. In rodents a DNA vaccine given orally in capsules has protected against challenge with rotavirus. For vaccination against respiratory diseases, researchers hope that DNA vaccines might be effective when delivered as a nasal spray, so that the immune response will be centered on the respiratory tract.

Scientists have been studying DNA vaccines for diseases of the horse. At the University of Wisconsin a DNA vaccine for equine influenza has been developed and DNA vaccines for other viral diseases including equine herpesvirus-1 and equine infectious anemia are being investigated elsewhere. The advances using rodent models give promise that oral DNA vaccines for equine rotavirus will be forthcoming.

Other viral diseases including rabies and the various equine encephalitic viruses are strong candidates for DNA vaccination. Equine diseases caused by bacteria or parasites might be addressed once the specific genes of those more complex organisms have been identified that encode targets the equine immune system can attack most effectively.

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N A T I O N A L

EEE/WEE Update

The Centers for Disease Control and Prevention (CDC) reported 114 cases of Eastern equine encephalitis (EEE) and 9 cases of Western equine encephalitis (WEE) in horses during 1997 **(Figure 1)**. Not all horses with neurologic disease are tested for viral encephalitis, therefore these numbers represent only confirmed cases reported to CDC.

EEE and WEE are diseases which can be transmitted between animals and people. Fourteen human cases of EEE were reported in 1997. No human cases of WEE have been reported since 1994, with only 3 cases occurring between 1990 and 1993.

Birds are the reservoir for the EEE virus in nature. Mosquitoes obtain the virus by biting an infected bird, then transmitting the virus by biting a horse or human.

Because of the public health significance of EEE and WEE, some states have instituted testing programs for birds and mosquitoes **(Figure 2)**. In addition to the states which have reported the presence of EEE/WEE virus in these monitoring programs, EEE has been reported in emus (large, flightless birds) in Arkansas, Georgia, Mississippi, Virginia and Wisconsin during 1996-1997.

In 1998 New Jersey had an increased incidence of EEE in horses. Dr. Janice Nicol, NJ Department of Agriculture Equine Epidemiologist, reported 9 confirmed equine cases of EEE from August 1 to November 1, 1998. All horses died or were euthanized in the end stages of the illness; none of the horses were vaccinated. One farm had 2 horses die from the disease. The animals ranged in age from 1-25 years (average 6 years); breeds affected were Thoroughbred, Standardbred, Quarter Horse and Shetland pony.

The 1998 New Jersey cases and the 1997 United States distribution of equine cases and positive sentinel animals/mosquitoes emphasize the need for yearly vaccination of all horses for EEE/WEE. Horses in the southeastern US and in endemic areas should be vaccinated more frequently according to local veterinary recommendations. With the cross-country transportation of horses for competition, trail riding, breeding and other activities, protection against this deadly disease is important even if the horse resides in a state which does not have yearly cases of EEE/WEE.

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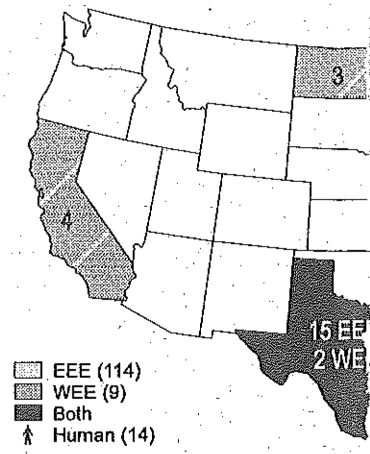
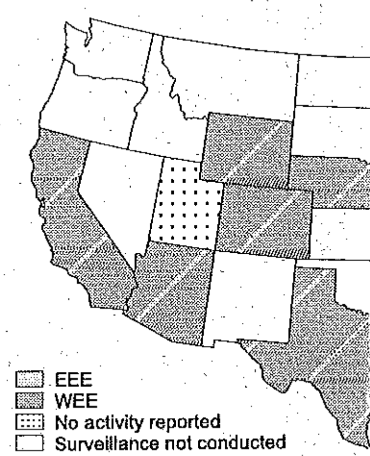


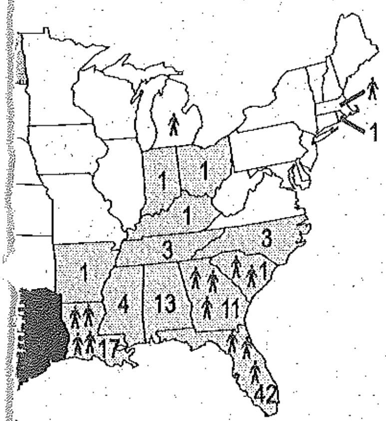
Source: Centers for Disease Control

Figure 1. Cases of EEE and WEE in

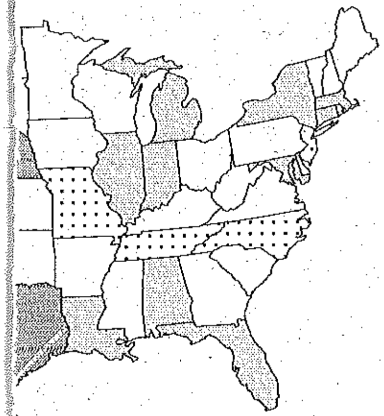


Source: Centers for Disease Control

Figure 2. Reported Enzootic Activi
in Mosquitoes or Sentinel or Wil



Horses, and EEE in Humans, 1997



ity of EEE and WEE Virus
l Birds, 1996-1997

The "Trollop"

There is one gait of the horse which has received little attention but which is of sufficient interest to merit discussion. That gait is often known as the "run," the leap or the bound. In the normal diagonal (transverse) gallop one has the sequence, on the left fore lead: RH-LH-RF-LF-FLY. Fly is the time when all four feet are off the ground. With the run there is: RH-LH-FLY-RF-LF-FLY. That is, the horse bounds or leaps off the two supporting hind legs into the diagonal fore leg, so that there are two fly periods per stride rather than just one.

This is the gait so often depicted in ancient art and Currier and Ives prints, for example: the hind legs stretched out to the rear and the fore legs to the front. One sees this gait routinely when a horse jumps over an obstacle and when starting out of the gate for a race. It can occur at other times as well but is usually not noticed. It is seen with some frequency, however, in racing Quarter Horses and can be easily seen in the finish photos of many Quarter Horse races. Amusingly, this gait is well-known to racing Quarter Horse people and is known as the "trollop." It got the name because it was felt the horse was trotting and galloping at the same time. That is not possible since the trot and gallop are only defined for the movement of all four legs. There is no trot or gallop for two legged animals; they either walk or run.

The leap or bound gait is common in deer, gazelle, antelope and the cheetah. It is somewhat faster than the ordinary diagonal gallop, or should be; there are no data on this point.

There is no way of knowing whether the old artists recognized this leaping gait or whether they made it up. It would appear, though again there is not enough information to be sure, that smaller horses pushed to maximum speed are more likely to utilize the run, perhaps an explanation for the racing Quarter Horse. That could also be an explanation for the artists' depictions as they observed smaller horses rather than the larger modern breeds.

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Effects of Weaning on Growing Foals

Every foal must be weaned from its dam at some point. However, when and how the weaning process is undertaken may have significant effects on the growing horse. One of the physiological responses often noted at weaning is a reduction in rate of weight gain.

In a study on Thoroughbred farms in Central Kentucky, average daily gain in the week following weaning was reduced to 33% of the rate observed before weaning. Average daily gain rebounded in the second week following weaning and then averaged about 68% of the preweaning rate in the next 8 weeks. An interesting finding was the reduced radiographic density of the cannon bone after weaning. However, in a later study at the University of Kentucky, a similar reduction in radiographic bone density was not observed after weaning.

The difference in the results may be related to the way the foals were managed at weaning. In the first study, many of the foals were confined to stalls for several hours each day following weaning; whereas in the University of Kentucky study, foals were maintained on pasture approximately 22 hours per day and were placed in stalls only at feeding. A Michigan study recently reported that stalled yearlings also had a reduction in radiographic bone density that was not observed in age-matched controls maintained on pasture.

Another goal of the University of Kentucky study was to evaluate effect of age on weaning. Foals were weaned at either 4.5 months of age or 6.0 months of age. To compensate for possible seasonal effects, foals were matched so a 6-month old foal and a 4.5-month old foal were weaned on the same day and then kept in the same pasture. Although it was suspected that younger foals would be affected by weaning more than the older foals, weaning at an older age did not reduce the depression in average daily weight gain observed in the first week after weaning. Furthermore, at 8 months of age, there was no difference in either height at the withers or body weight between the two weaning groups.

Researchers in Virginia and New Jersey have compared single and paired weaning. In each case, foals were separated from their dams and placed in box stalls, either alone (single weaning) or with another foal (paired weaning). The Virginia Tech study found that although single-weaned foals tended to be more vocal than paired-weaned foals, cortisol responses indicated that paired weaning was more stressful than single weaning. In the Rutgers, New Jersey, study single-weaned foals had normal cell-mediated immune responsiveness whereas this response variable was depressed in the pair-weaned foals. Both studies concluded single weaning was less stressful than paired weaning.

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Bibliographies

The following bibliographies are available from the Morris Library, Maxwell H. Gluck Equine Research Center:

- Alternative therapies in the horse
- Colic in the horse
- Equine protozoal myeloencephalitis
- Exercised-induced pulmonary hemorrhage in the horse
- Plants poisonous to the horse
- Wobbler syndrome in the horse

Copies may be obtained by contacting Gracie Hale at ghale@ukcc.uky.edu or (606) 257-1192.

Parasitism in Horses

Over the past several years, there has been an increased interest in the role of small strongyles in disease production in horses. In contrast to their larger cousins, it was previously held that small strongyles were of low pathogenicity to horses; however, it is now accepted that these parasites often result in severe disease.

Small strongyles, also referred to as cyathostomes, and the disease they cause as larval cyathostomosis, are a group of parasites that inhabit the colon and cecum of horses. Up to 40 different species of small strongyles have been identified and they represent the most common parasites of horses on pasture. Adult worms living in the lumen of the intestine produce eggs that pass into the environment. There the eggs hatch and develop into infective larvae and horses ingest the larvae as they graze. Once inside the gastrointestinal tract of the horse, the larvae penetrate the large intestine and become encysted. It is this process that can cause disease.

Normally, after a period of one to two months of further development, the larvae emerge and return to the lumen of the intestine where they mature into adults. If low numbers of larvae are involved in this process, the effects on the horse are minimal. If, however, a large number of larvae enter a period of arrested development (which can happen under certain conditions) problems can ensue. Various factors can trigger simultaneous emergence of large numbers of larvae with disease resulting from the associated inflammation and damage to the intestine. Signs that are observed with cyathostomosis can include diarrhea, colic, weight loss, weakness, and edema. Diagnosis can be difficult and it is often made only at necropsy. Fecal examination for eggs is associated with inconsistent results; however, demonstration of larvae in the feces can be helpful in arriving at a diagnosis.

In central Kentucky, where management practices are typically excellent, there have still been 45 cases of larval cyathostomosis diagnosed at the University of Kentucky Livestock Disease Diagnostic Center over the past 6 years. Yearly totals ranged from 4 to 11 cases. Although the ages of affected horses were from 6 weeks to 33 years, our results indicate that this is a disease affecting primarily adult horses. Twenty-three horses were 1 to 5 years of age, 15 were greater than 5 years old, and only 7 were less than one year of age.

In approximately 50% of the cases it was believed that the small strongyle infestation was the primary cause of death, while in the other cases the parasites represented a secondary problem. Signs of disease described in the horses submitted to the diagnostic laboratory were similar to other reports and included primarily weight loss and diarrhea, with fewer showing weakness, colic, or death with no prior signs of illness. Gross lesions seen at necropsy ranged from no observable change to loose content, pinpoint-sized nodules in the mucosa of the cecum and colon that were sometimes hemorrhagic, and edema of the cecum or colon. Microscopically, cyathostomosis typically was characterized by encysted larvae within the mucosa and submucosa with edema and accumulation of inflammatory cells around the cysts.

Control of small strongyle infestation can pose several problems. Treatment after the onset of clinical signs can be difficult due to rapid onset and severity of disease. Many dewormers are only effective against adult small strongyles. The most effective control is achieved by the regular use of anthelmintics that are efficacious against the tissue stage. Several products are available that have been shown in studies to have significant efficacy against encysted cyathostome larvae.

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