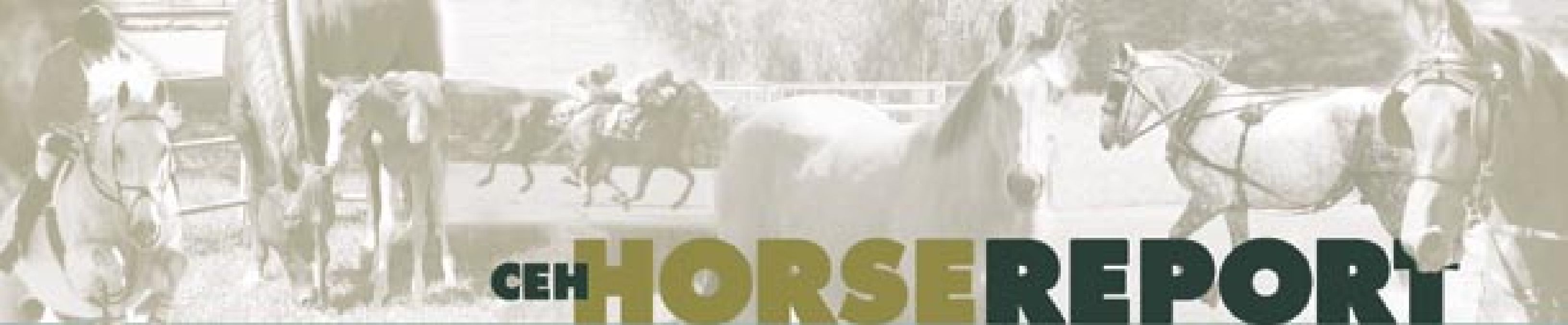

CEH HORSE REPORT

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African Horse Sickness in North America? Lessons Learned from Recent Viral Epidemics

Infectious disease is a major problem in the developing world, but the emergence of diseases is a huge public health threat everywhere, especially with the impact of being able to travel to any point in the world in a day. Diseases don't respect borders.

The introduction and spread of a livestock virus into a country or continent can have tremendous veterinary and economic consequences and possibly impact human health. Many viruses that infect livestock and humans are transmitted by insects (arthropods). They include small biting flies known as midges, mosquitoes, ticks, black flies and sand flies. The viruses they carry are called *arboviruses* (short for arthropod-borne viruses) and include diseases like West Nile and other types of viral encephalitis. One arbovirus disease of concern to equine veterinarians is African horse sickness.

Yearling Boerperd horses from the Northern Cape Province, South Africa. These horses were brought to the University of Pretoria's School of Veterinary Medicine as part of the second-generation vaccine development study for African horse sickness. The Boerperd is a true South African horse breed with a long and illustrious history. Its lineage can be traced back to 1652 and the establishment of a halfway post to serve ships of the Dutch East Indian Company.

African horse sickness is a serious, often fatal disease of horses and mules and is transmitted by a biting midge of the genus *Culicoides*. This disease is of particular concern because the mortality rate can be as high as 95% in some forms of the disease.

As its name indicates, African horse sickness is a truly African disease that is generally confined to the sub-Saharan regions of the continent from which it spreads occasionally to North Africa. In 1855, an outbreak of the disease killed 40% of the entire horse population of South Africa—about 70,000 horses. A few outbreaks have occurred outside Africa, including the Near East and Middle East, Spain and Portugal. Cases of African horse sickness appeared in southern Spain in 1989 and 1990, just before the 1992 Olympic games. Had the outbreak not been contained, it would not have been possible to hold the equestrian events in Barcelona.

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DIRECTOR'S MESSAGE

Science Only Half the Battle in Defending Against Emerging Infectious Diseases

Dr. Gregory Ferraro

"One Health" acknowledges that humans do not exist in isolation, but are part of the larger, total living ecosystem, and that the activities and conditions of each member affect the others.

This issue of our *Horse Report* discusses the many challenges involved in managing viral diseases transmitted by insect vectors, specifically those caused by *orbiviruses* (pathogens primarily in animals) such as African horse sickness and bluetongue. We discuss these diseases not only because we believe that they pose a significant risk to the horse and livestock population of the United States, but also because they demonstrate the complexities—scientific, political, and economic—involved in ensuring the health and safety of animals and humans alike.

In today's world, two-thirds of the emerging infectious diseases are of viral origin. Of those emerging viral diseases, 20% are transmitted by insect vectors. Although orbiviruses cause disease mainly in animals, consider that 70% of the viral diseases in humans have origins in animals (e.g., HIV, avian influenza) or are related to animal diseases. It would be naïve to ignore that orbiviruses might also pose a threat to human health. The example in this *Horse Report* of the bluetongue virus outbreak in Europe should perhaps be considered just the "tip of the spear" for what could potentially follow in the future. The rapid spread of West Nile virus across North America and our current difficulties with avian and swine flu demonstrate that we are not immune to such problems and that, indeed, the concept of "One Health" across the world rings increasingly true.

As in all epic battles, victory comes through the correct assessment of risk, effective strategy, careful planning and proper implementation of resources. In disease control, those processes involve a mixture of science and public policy. Risk assessment and control strategies are developed through continuous scientific research. Research takes the long-term view of what future problems lie ahead and begins the tedious investigative process of developing the basic knowledge necessary to effectively face health threats that may be decades in the offing. Forward-thinking scientists begin working toward understanding the transmission and infectious capabilities of diseases years before the public is even aware they exist. It is this preparation that lays the groundwork for effective disease control by public policymakers when the diseases do emerge to pose a health threat. These often privately funded efforts of researchers to develop the basic knowledge required for developing vaccines or other biological armaments are the first steps needed to ensure success in the disease control battles that will later ensue.

Secondly, the resulting tools of these scientific endeavors cannot be implemented or realized if private and public support does not coalesce to bring them from the laboratory to the health care marketplace. Just because a concept for an improved vaccine is developed by science, it does not necessarily follow that it will be manufactured, stockpiled and ready when needed. In other words, our battle strategy can and does often fall short because public policy planning and preparation have not taken place to effectively implement our defenses in advance of attack.

The process from scientific discovery to mass marketing of biological and pharmacological products is a long, arduous and expensive one. It is understandable that pharmaceutical companies may be reluctant to bring such new products through the process when the market for them is questionable. The cost of doing so is just bad business. It is for precisely those reasons that you, the horse owner and citizen of the world, should become involved in pushing governmental and other public health entities toward making effective investments against future disease threats. Should we not as a society be willing to invest resources to develop and stockpile biological defenses that may be needed to combat some future health emergency? Should we not, for our own benefit, assist in every way possible in sustaining scientific discovery and market implementation of products necessary to protect our health and safety as well as those of our animals and our environment? If the current worldwide crisis with the H1N1 virus is an example of what could happen, I believe we can and we should.

In light of the foregoing comments and as proof positive of what private funding support can do, I would like to salute the significant contribution of the Harriet E. Pfleger Foundation in the development of the bluetongue and African horse sickness vaccines described in the pages to follow. The foresight and willingness of the trustees to financially support, over the course of many years, the basic scientific processes that eventually led to the development of these new types of vaccines should be recognized for what it is: a significant contribution to the world's health. We at the Center for Equine Health hope that you will join us in acknowledging the Harriet E. Pfleger Foundation for their efforts on our behalf. ❆

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Some researchers speculate that climate change may play a role in increasing the risk for spread of this and other insect-transmitted diseases. The primary *vector* (the insect that carries disease-causing microorganisms from one host to another) for this disease—*Culicoides imicola*—is now present throughout large portions of North Africa and southern Europe. Of even greater cause for concern, other *Culicoides* species have spread viruses that are very closely related to African horse sickness virus throughout Europe, as far north as Scandinavia. Some of these new potential vectors also exist in North America.

The Role of Climate Change in Spreading Disease

Our increasing understanding of potential climate change has transformed how we view the boundaries and determinants of human and animal health. While human health may seem to relate mostly to behavior, heredity, occupation, local environmental exposures, and health-care access, sustained human and animal population health also requires the life-supporting "services" of the biosphere. Life depends on supplies of food and water, freedom from excess infectious disease, and the physical safety and comfort provided by climatic stability. The world's climate system is fundamental to this life support.

The Intergovernmental Panel on Climate Change—created in 1988 to provide a scientific view on the current state of climate change and its potential consequences—estimates that global surface temperature will probably rise 2.0 to 11.5° F during the 21st century. We should not wait to see if this prediction comes true.

The years between 1995 and 2006 ranked among the 12 warmest since records began in the 1850s. Many areas have experienced increases in the frequency and intensity of rainfall, others have seen extended droughts. Even with the implementation of mitigating measures, warming may continue beyond 2100 because of the large heat capacity of the oceans and the long lifetime of carbon dioxide in the atmosphere.

One of the more significant negative effects of climate change on human and animal health is that it may change the geographic range of insect-borne diseases, potentially bringing them to areas where they have not existed before. We have already begun to see this happen. The effects of rising temperatures, changing wind and rain patterns and relative humidity can potentially include:

- Changes in the distribution boundaries of insect vectors such as mosquitoes, *Culicoides* midges, ticks, black flies and sand flies
- Acceleration of development rates of viruses within insect vectors
- Increased numbers of insects in a given area
- Enhancement of insect longevity and thus on its capacity to carry and spread pathogens
- Extension of transmission ability to additional vector species

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The recent importation of West Nile viral encephalitis into the Americas marked the first time West Nile virus had been found in the New World. The virus existed in Africa and the Middle East for decades, if not many centuries, but in 1999 it appeared in New York via an unknown route. The infection then spread across the United States, with different hot spots each year, eventually making its way to the west coast. All the makings were in place for an epidemic: the right vector (mosquito), the right microbe (West Nile virus) and suitable hosts (birds, horses and humans).

According to a study published in the journal *PLoS Pathogens*, higher temperatures helped West Nile virus spread across North America. The researchers found that since the introduction of West Nile virus in 1999, a newer strain of the virus emerged and spread rapidly, completely displacing the original strain by 2005. Coincident with the spread of this new strain were two of the largest epidemics of West Nile virus recorded to date in North America, with 4,582 cases reported in 2002 and 11,356 cases in 2003.

Laboratory tests were conducted to determine how soon mosquitoes were capable of transmitting the virus after feeding on infected blood. The study revealed that the new strain was more efficiently transmitted than the old strain and the advantage of the new strain increased with higher temperatures. These results provide a striking example of how climate and evolution can interact to increase the transmission of a virus.

Climate change has far-reaching consequences and touches on all life-support systems. Undeniably, it is a factor that should be placed high among those that affect human and animal health and survival. At the same time, the emergence of disease is a complex process that involves consideration of factors other than climate alone.

There are a number of other pathways for introducing disease to a new area, some that are naturally occurring and others that are the result of human activities. Natural pathways include:

- Changing wind currents that carry insects to areas beyond their normal locations
- Changing migratory patterns of birds
- Evolution of microbes
- Evolution of insect vectors

Pathways resulting from human activities include:

- Increased international travel and commerce
- Importation of domestic animals, wildlife or animal products
- Agricultural practices and deforestation (more irrigation systems and dams providing moist breeding habitats)
- Urbanization and population growth in developing countries
- Disruption of normal agricultural and hunting activities by regional wars
- Smuggling of animals or animal products by humans
- Intentional introductions by terrorists

Any of these factors may work alone or in combination with climate change to promote the emergence of insect-borne diseases. In any case, combined with large susceptible animal and human populations, the presence of competent vectors, and a public health infrastructure that is not well prepared, these are elements that create vulnerability to intense health crises, be it in human or animal populations—or both.

Bluetongue Virus in Europe

Bluetongue virus is a disease of sheep, cattle, goats and other ruminants that is caused by a "kissing cousin" virus to that responsible for African horse sickness. It is particularly damaging in sheep; half of an infected flock may die. The infection also is transmitted by the same *Culicoides* species as for African horse sickness and causes inflammation, swelling and hemorrhage of the mucous membranes of the mouth. The nose and tongue may appear red or dirty blue in color; hence, the name of the disease. It has the potential for rapid spread and has major significance in the international trade arena.

Although bluetongue virus occurs throughout tropical and temperate regions of the world, prior to 1998 outbreaks in European countries had been sporadic, transient and relatively rare. In each of these outbreaks, only one or two countries were affected at a time and only a single bluetongue virus *serotype* (a subtype of the virus) was involved. However, between 1998 and 2005, six strains of bluetongue virus entered Europe from at least two origins—east via Turkey and west via north Africa—and spread across 12 countries up to 500 miles further north in Europe than ever before.

Additional and different serotypes of bluetongue virus invaded northern Europe between 2006 and 2008, so that now eight different serotypes of bluetongue virus occur on the continent. None were widespread in this region prior to 1998. This has led to the death of several million sheep and other ungulates (hoofed mammals) and has caused major disruption to trade in livestock and livestock products.

Researchers studying the emergence of bluetongue and other insect-borne virus infections in Europe believe that this dramatic spread of bluetongue virus is linked to climate change. Not only did the distribution of bluetongue virus expand dramatically northward, but transmission occurred even beyond the range of the primary *Culicoides* species (*C. imicola*), indicating a new role in the transmission of the disease for local European *Culicoides* species in these areas.

The presence of bluetongue virus in Mediterranean Europe caused a considerable economic impact on the countries affected. In an effort to stop the circulation of the virus, governments in affected countries elected to vaccinate livestock. In southern Europe, modified live vaccines were used to control the disease because that was all that was available at the time. However, these original South African "live" vaccines that were available for bluetongue virus actually caused the disease in some breeds of European sheep and thus animal health officials faced a new set of problems.

This experience revealed that modified live vaccines have a number of disadvantages:

- They may cause reproductive effects and therefore should not be used in pregnant animals.
- The modified live virus contained in the vaccine can be transmitted by insects to unvaccinated animals.
- In some situations it appears that the viral strain (serotype) contained in the vaccine can recombine with field strains to create yet new strains or serotypes from which there is no protection.

As a result of this bluetongue crisis in the southern regions of Europe, safer inactivated vaccines were used exclusively in northern Europe. Although they are effective, these inactivated vaccines also have limitations: (1) time needed for their production, (2) difficulty in maintaining vaccine banks

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for all serotypes of bluetongue virus, and (3) the slow onset of immunity in animals vaccinated during an outbreak. The limitations of inactivated and modified live virus vaccines have spurred the development of newer recombinant vaccines that have the safety of inactivated vaccines and the many advantages of modified live virus vaccines.

For the future, it is important to know how far north bluetongue and other important arboviruses (including mosquito-borne diseases that can affect people) might expand at a time of ongoing climate change, and also the risk they will pose to animals and sometimes humans. Research is needed to improve diagnostics and vaccine production, to investigate the transmission of insect-borne viruses and the ways in which they survive the winter, and to learn more about vector ecology and control.

African Horse Sickness

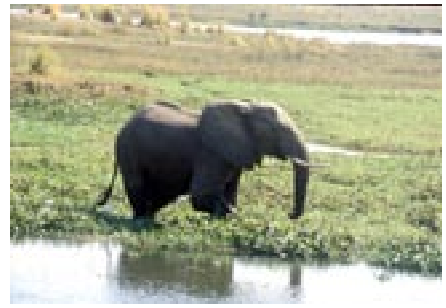
As its name indicates, African horse sickness is a truly African disease that is prevalent in sub-Saharan Africa from which is has spread occasionally to North Africa, southern Europe, the Middle East, and even the Indian subcontinent. In 1855, an outbreak of the disease killed 40% of the entire horse population in South Africa—about 70,000 horses. A few outbreaks have occurred outside Africa, including the Near East and Middle East, Spain and Portugal.

African horse sickness is transmitted by the same primary insect species that transmits bluetongue virus— *Culicoides imicola*—though other species are suspected of being capable of spreading this virus as well. Wind has been implicated in the dispersal of infected *Culicoides* vectors in some epidemics. Transmission by insects other than midges is thought to be a minor source of infection. Mosquitoes have been implicated as biological vectors, and some other types of flies may be able to transmit the virus mechanically (e.g., by carrying it on their bodies).

Clinical signs. The severity of the disease in susceptible horses varies with the virulence of the specific strain of virus. (Subspecies or "serotypes" of the virus each have unique characteristics.) There are several different forms of the disease.

The ***pulmonary form*** usually begins with an acute fever, followed by the sudden onset of severe respiratory distress. Infected animals often stand with forelegs spread, head extended, and nostrils fully dilated. Other clinical signs may include rapid breathing, forced expiration, profuse sweating, coughing, and a frothy nasal discharge. Shortness of breath usually follows, and the animal often dies within a few hours after the respiratory signs appear. The pulmonary form of African horse sickness is most common in completely susceptible horses infected with a highly virulent virus.

The ***cardiac form*** usually begins with a fever that lasts for 3 to 6 days. Shortly before the fever starts to subside, edematous swellings appear in the eyelids and above the eye socket. These swellings later spread to involve the cheeks, lips, tongue, jaw, and sometimes the neck, shoulders and chest.



Other clinical signs, usually seen in the terminal stages of the disease, can include severe depression, colic, bruising on the surface of the tongue, and red spots caused by bleeding in the conjunctivae of the eyes. Death often occurs from cardiac failure. If the animal recovers, the swellings gradually subside over the next 3 to 8 days. Mortality rates for this form of the disease may be as high as 50%.

The acute or ***mixed form*** of African horse sickness has symptoms from both the pulmonary and cardiac form. In most cases, the cardiac form has no outward signs and is followed by severe respiratory distress. Occasionally, mild respiratory signs may be followed by swelling and death from cardiac failure. The mixed form of African horse sickness is rarely diagnosed clinically but is often seen at necropsy in horses and mules. Mortality is approximately 70%.

In ***horsesickness fever***, the clinical signs are mild. The characteristic fever usually lasts for 3 to 8 days. Other symptoms are generally mild and may include decreased appetite or depression, swelling above the eye socket, congested mucous membranes and an increased heart rate. Animals almost always recover from horsesickness fever.

Diagnosis. Clinical diagnosis of the pulmonary and cardiac forms is not difficult because of the spectacularly severe nature of the disease and characteristic swelling of the area above the eye socket. Similarly, the severe pulmonary edema (build-up of fluid in the lungs) and pericardial and pleural effusion (excess fluid around the heart and lungs) seen at postmortem examination provides a further reason to suspect the disease, especially in areas where the disease occurs. Laboratory tests such as enzyme-linked immunosorbent assays (ELISA) and reverse-transcription PCR assays can be used to detect viral antigens. Serological tests also can be used to diagnose African horse sickness in animals that recover from infection. However, horses that recover from natural infection cannot be distinguished from those that have been vaccinated with modified live virus vaccines.

Vaccinations. Attenuated modified live virus vaccines are routinely used for control in Africa but may not be licensed in other areas. These vaccines result in viremia (where virus particles circulate and reproduce in the bloodstream) and the viruses could theoretically be transmitted to vector insects and potentially revert to virulence or reassort with an outbreak virus. (Reassortment of viruses means that viruses of different types exchange genetic material, resulting in a genetically different virus as occurs with influenza viruses.) Thus, live attenuated vaccines may not be safe in countries that are free of African horse sickness. Like bluetongue, the vaccines used in Africa for African horse sickness were developed more than 50 years ago and have a number of serious problems. There is a need for new- generation recombinant vaccines.

Could African Horse Sickness Follow Bluetongue Virus?

African horse sickness is a caused by a "kissing cousin" virus to that responsible for bluetongue. It is transmitted by the same *Culicoides* insects.

The very disconcerting message to the rest of the world from the recent spread of bluetongue virus into Europe is that exotic strains of virus can move into previously disease-free regions, including those previously free of the known vector species but in which other "nonvector" *Culicoides* species reside. Furthermore, the remarkable expansion of a particularly infectious strain of bluetongue virus—serotype 8—into northern Europe and Scandinavia in 2006 indicates that *climate no longer can be relied on to confine bluetongue to its traditional global range*.

According to a 2009 study published in the British journal *Epidemiology and Infection*, the overall risk of African horse sickness occurring in Europe is predicted to be increased by climate change. It is clear that the global distribution of several *Culicoides*-transmitted infections of livestock has altered drastically in recent years. While the precise mechanisms responsible for these events is not proven, we do know that the wind-borne dispersion of virus-infected *Culicoides* insects can spread these viruses over long distances, as can the movement of virus-infected animals. Human activities, including the intentional or unintentional introduction of viral-contaminated products, also can result in long-distance translocation of viruses.

Outbreaks of African horse sickness virus beyond its previously confined areas have already occurred in Europe, such as in Spain and Portugal. The most important known insect vector for African horse sickness is *Culicoides imicola*, the same principal vector as for bluetongue virus. Not only is climate change likely to potentially alter the distribution of *C. imicola*, but it also may increase the ability of local, alternate *Culicoides* species to spread African horse sickness virus beyond its normal range, as so dramatically occurred with bluetongue virus.

It is difficult to predict which of the many species of *Culicoides* insects that occur worldwide ultimately will prove to be effective vectors of African horse sickness virus. Until better predictive models are available, it would be unwise for any country with resident populations of *Culicoides* insects, regardless of current status for arbovirus infection, to assume that one or more of these viruses could not emerge at some time in the future. This

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message certainly should be heard in the United States and other countries that have abundant populations of many of these insect species that already transmit a rich variety of viruses like bluetongue virus—closely related to African horse sickness virus.

Building Defenses through Research

In the ongoing struggle between microbes and humans, we rely heavily on basic science, its applications, intellectual capital, and research facilities. It is a perpetual challenge.

Effective vaccines are critical to the continued safe international movement of horses and to the control of infectious diseases around the world. New-generation vaccines that offer the promise of increased safety and efficacy are increasingly being developed, but this is a lengthy process. It requires a sound understanding of the biology of each virus and the step-by-step development of infection, including what can provide protective immunity. All of these issues are required in order to design an improved vaccine.

Researchers in the **UC Davis Equine Viral Disease Laboratory**, under the direction of Dr. Jim MacLachlan, have spent many years working on a recombinant vaccine strategy, first for bluetongue virus and later for African horse sickness. Bluetongue virus in sheep was used as a "local" model of African horse sickness because the latter could be worked on only in South Africa where the disease is endemic. Only certain genes of these viruses were used so that live bluetongue or African horse sickness viruses were never included in the vaccines. The goal was to develop vaccines that rapidly induce sterilizing immunity in vaccinated animals and that allow the capacity to distinguish vaccinated animals from naturally infected ones.

Through partnerships with Merial, Inc., Sanofi-Pasteur, Inc., and the Equine Research Centre at the University of Pretoria, South Africa, Dr. MacLachlan and researchers in the UC Davis Equine Viral Disease Laboratory have now realized some of these goals. New-generation recombinant vaccines have been developed against individual serotypes of both bluetongue and African horse sickness using a strategy that is already used in Merial's Recombitek West Nile vaccine. These vaccines and the technological advancements they reflect represent a very significant step in the advancement of animal disease control. Essential to the success of this program has been the international collaboration of scientists in the United States, Canada, France and South Africa.

The science for developing a new-generation vaccine for African horse sickness has been completed and validated in South Africa in experimental studies led by Professor Alan Guthrie, Director of the Equine Research Centre at the Faculty of Veterinary Science, **University of Pretoria, South Africa**. The new vaccine is now ready for provisional licensure, which must be done by the industrial partner (Merial, Inc.). Industry and government agencies must now come together to invest in the future of the technology and to promote the fruits of scientific endeavor into the marketplace.

The development of these new vaccines is the culmination of a focused research effort over 20 years. Critical funding support for this research was provided by the **Harriet E. Pfleger Foundation** who had the vision and foresight to support the basic research that led to these developments. The international animal community and their governing bodies throughout the world owe a very substantial debt of gratitude to them for making this possible. We commend the Foundation's trustees for their contribution to the welfare of animals

African horse sickness is transmitted by the blood-sucking insect *Culicoides*, a small biting fly, so the disease occurs only where competent vector insects are present. *Culicoides* insects are abundant on all continents except Antarctica, but to date just two of the 1300+ species of these insects have proven to be competent vectors of African horse sickness virus. However, other closely related *Culicoides*-transmitted viruses such as bluetongue virus have recently expanded their ranges in both Europe and North America, possibly as a result of climate change.

Culicoides sonorensis

Of additional concern, the spread of bluetongue virus in Europe is associated with *Culicoides* species that had not previously been known carriers of the virus. Several species of *Culicoides* insects resident in the region of the northern Europe not previously considered as likely vectors are now efficiently transmitting the virus. Thus, there is considerable concern that African horse sickness virus might soon follow the path blazed by bluetongue virus into Europe and North America. An incursion of African horse sickness similar to that caused by bluetongue virus in the UK in 2006-2007 would be catastrophic to the global horse industry.

PHOTO: Adult biting midge, *Culicoides sonorensis*, a common type of this insect that is quite widespread. Photo shows blood-filled abdomen and the characteristic wing patterns used for species identification.

and the advancement of medical science.

The Equine Viral Disease Laboratory in the UC Davis School of Veterinary Medicine was dedicated in 1999 to facilitate the diagnosis, control and study of viruses that have the potential to cause disease in horses and possibly humans. The laboratory was made possible by a generous gift from Dr. Bernard and Mrs. Gloria Salick. Long-term support for the laboratory's research has been provided by the Harriet E. Pfleger foundation, the Bernice Barbour Foundation, and the Stans Foundation.

Through the international outreach activities of the faculty in the Equine Viral Disease Laboratory, the seeds were sown more than 10 years ago for creation of a recombinant vaccine to prevent African horse sickness. This vision was translated into reality with provisional patenting of the vaccine in 2009, reflecting the efforts of industry and academic partners both at UC Davis and the University of Pretoria.

What You Can Do Now

Tomorrow is the most important thing in life. Comes into us at midnight very clean. It's perfect when it arrives and it puts itself in our hands. It hopes we've learned something from yesterday. – John Wayne's tombstone

When bluetongue virus serotype 8 erupted in northern Europe in 2006, the only available vaccines were the modified live virus vaccines with the inherent problems discussed earlier. Regulatory officials declined to use live attenuated vaccines, but it took two years to develop inactivated vaccines and by then the disease outbreak had spread throughout the region, causing extensive animal losses and disrupting trade.

Let us learn from yesterday as we consider the possibility of facing African horse sickness tomorrow. In the UK, The Horse Trust has acknowledged that the horse is a low priority for the Department of the Environment, Food and Rural Affairs—the British equivalent of the U.S. Department of Agriculture. The Horse Trust has taken action to:

- Educate horse owners to make them aware of the possibility of a strike by African horse sickness, along with symptoms to watch for.
- Provide information to the equine veterinary profession to ensure early diagnosis. Some of the diseases that pose the greatest threat occur rarely, so they may be unfamiliar to many clinicians.
- Support a research program to evaluate the likely impact of the disease and develop appropriate control measures.
- Ask their government about what plans are in place to deal with an outbreak of African horse sickness should it appear in the UK.

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African Horse Sickness
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- Ask their government to assess the likely impact of African horse sickness on the country's $6.6 billion equine industry.
- Ask their government to support research into the prevention and control of African horse sickness in the UK.

In the United States, the equine community should be doing the same. At the present time, all funding for animal health research through the USDA is for food animals. Equine organizations and individual horse enthusiasts need to become politically active, to press policymakers at the federal level to invest in the welfare of nonfood animals. Horses are of enormous consequence to the U.S. economy as well as to American life. Their impact financially and socially is demonstrated by the following statistics published by the American Horse Council:

- There are 9.2 million horses in the United States.
- 4.6 million Americans are involved in the industry as horse owners, service providers, employees and volunteers. Tens of millions more participate as spectators.
- 2 million people own horses.
- The horse industry has a direct effect on the U.S. economy of $39 billion annually.
- The industry has a $102 billion impact on the U.S. economy when the multiplier effect of spending by industry suppliers and employees is taken into account. Including off-site spending of spectators would result in an even higher figure.
- The industry directly provides 460,000 full-time jobs.
- Spending by suppliers and employees generates additional jobs for a total employment impact of 1.4 million full-time jobs.
- The horse industry pays $1.9 billion in taxes.

Considering that it has taken one year to produce and distribute the H1N1 flu vaccine, and that initial estimates on the number of vaccines that would be available were overly optimistic, it will be some time before the newly developed vaccine for African horse sickness is available to farms and stables across America. Similarly, although "proof of concept" has been established with the recombinant African horse sickness vaccine, the product is not licensed for the United States and to do so would require an enormous investment for a product that currently has no market. However, if an outbreak of African horse sickness were to occur in Europe or North America, the economic consequences would be enormous and the effects would be long-lasting. The best defense is to recognize the possibility and act now to meet a future threat should it occur. The challenge, of course, is to ensure that the fruits of scientific research are indeed available for use in an emergency.

One of the goals of infectious disease research is the development and production of countermeasures such as vaccines. The academic community has been concerned with basic research and concept development, but the development of products is something that properly belongs in the commercial sector. When industry has a product they know will generate a

major profit margin, they do not need much outside incentive to pursue advanced product development. However, if faced with the choice of putting $200 million into a new area, will pharmaceutical companies have the incentive to make a product to combat an emerging microbe for which there is an uncertain market, or will they develop a new Viagra?

Dr. Anthony Fauci, Director of the National Institutes of Allergy and Infectious Disease, proposed that new partnerships between industry and government are needed in the interest of promoting public health. *Project Bioshield* is a bill that was signed in 2004 and through which funding has been set aside as a guarantee to industry that if they make a product that serves an important public health need, the government will buy it at a fair price, even if it is never used. This provides an important incentive for industry to get involved in the production of vaccines and other biologics to support public health concerns and policies. Perhaps this could serve as a model for animal health as well.

Although there are a variety of ways to become involved in policy change, the American Horse Council is a national voice in the nation's capital and represents all segments and interests of the U.S. horse industry. It was organized by a group of horse enthusiasts concerned about federal legislation affecting horses and works to promote and protect all horse breeds, disciplines and interests by communicating with Congress, federal agencies, the media and the industry.

There is no doubt that, taken as a whole, the horse community can be a much larger and more powerful constituency than any one of its individual parts. We encourage you to add your voice to theirs in advocating for policies that protect and serve the health of horses and the viability of the equine industry. ❆

Other Emerging Orbiviruses

In addition to bluetongue virus and African horse sickness, we are seeing an emergence of other orbiviruses that should be of concern to the American live-stock industry. ***Equine encephalosis virus***, the cause of a milder and very sporadic disease similar to African horse sickness, recently emerged in Israel. This is the first time it has been detected outside of sub-Saharan Africa where the virus is enzootic.

Peruvian horse sickness is another orbivirus related to bluetongue and African horse sickness viruses. It causes fatal encephalomyelitis (inflammation of the brain and spinal cord) in horses in South America. This virus is transmitted by mosquitoes rather than Culicoides midges. An identical virus (Elsye virus) has been isolated from horses with neurological disease in the Northern Territory of Australia.

Dr. Carrie Finno Awarded Rowan Fellowship

Dr. Carrie Finno

Dr. Carrie Finno, a resident in large animal internal medicine at the Veterinary Medical Teaching Hospital at UC Davis, was awarded the Louis R. Rowan Fellowship by the California Thoroughbred Foundation.

Dr. Finno earned her veterinary medicine degree from the University of Minnesota College of Veterinary Medicine in 2004. Since 2007, she has been a United States Equestrian Federation (USEF) official veterinarian, performing drug testing at USEF-recognized horse shows.

The Louis R. Rowan Fellowship, which is funded by donations from the Oak Tree Racing Association, was established in memory of one of the California Thoroughbred Foundation's founders. Lou Rowan, in addition to being a noted racehorse owner and breeder, was active in many areas that benefited people and horses in the Thoroughbred world. Congratulations to Dr. Finno!

First North American Veterinary Regenerative Medicine Conference Slated for March 2010

The UC Davis Center for Equine Health, in collaboration with Alamo Pintado Equine Medical Center and the Rood and Riddle Equine Hospital, is pleased to announce the First North American Veterinary Regenerative Medicine Conference to be held March 5-6, 2010, in the beautiful Santa Ynez Valley just east of Santa Barbara, California. The conference will offer continuing education courses on regenerative medicine for veterinary practitioners.

To register or for more information, visit the website ***www.alamopintado.com/veterinarians*** or telephone (888)688-6510. You may also find additional information on the Center for Equine Health website at ***www.vetmed.ucdavis.edu/ceh*** (*What's New?* under Quicklinks).

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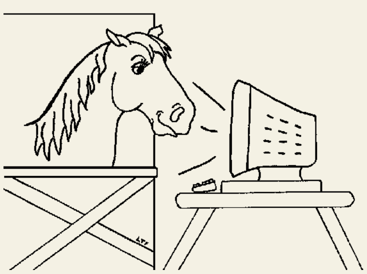

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