

REPORT OF THE COMMITTEE ON FOREIGN AND EMERGING DISEASES

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The Committee met on October 13th, 2009 at the Town and Country Hotel, San Diego, Calif., from 8:00 am to 5:30 pm. The beginning of the session included a thank you to former Committee Chair, Alfonso Torres and introduction of the new Vice-Chair, Tammy Beckham. In addition, there was a reading of the committee charge and a review of the 2008 Resolutions and the United States Department of Agriculture (USDA) response to those Resolutions.

Dr. Jim Clark from the Canadian Food Inspection Agency (CFIA), presented a time-specific paper on *Novel H1N1 Influenza A virus in Canadian Swine Herds*. The paper in its entirety is included at the end of this report.

UK Perspective on vector borne diseases in Europe : Bluetongue and AHS

Richard Drummond, DEFRA

Vector borne diseases of livestock and equidae have occurred for many years as occasional incursions into Europe from warmer climates, but since 2006, there has been renewed interest as a consequence of the unexpected (and unexplained) incursion of Bluetongue Virus type 8 (BTV8) with subsequent wide spread over 2007 and 2008.

The paper set out the pattern of recent spread of BTV serotypes since 2000, and gave an outline of the current control strategy which revolves around early detection, official reporting and investigation, controls over movements, sharing of information and use of inactivated vaccines (where these are available).

These recent events have prompted an urgent review of control policies for dealing with African Horse Sickness, with strong engagement with legislators in the European Community and with the equine industry in the UK. Looking to the future, Dr Drummond concluded that evidence for permanent climate change is firm and that accompanying changes in natural habitats could bring new threats to Europe from introduction and establishment of vector borne diseases. The impacts of this threat can be mitigated by a clearer understanding of trends in prevalence, epidemiology, well planned and executed surveillance, modelling and development of new tests and vaccines.

Equine Encephalosis: 2008 Occurrence in Israel

Peter Timoney, Department of Veterinary Science; Gluck Equine Research Center, University of Kentucky

Evidence of the northward migration of equine encephalosis virus from sub-Saharan Africa was provided by an extensive occurrence of the disease in Israel, October/November 2008. Initially believed to be equine viral arteritis based on limited serological findings, it was not until late March 2009 that a diagnosis of equine encephalosis was confirmed by PCR testing of viral isolates from several affected horses. Isolation and characterization of the virus strains was performed by the Kinron Veterinary Institute, Israel and VLA, Weybridge, UK.

The disease was first reported around October 1, after which it spread over the ensuing weeks, involving an estimated 80% of the country's equine population. The total number of recorded outbreaks was 42, most of which were localized along the Mediterranean coast. Typical clinical manifestations in affected horses involved fever up to 40 - 41° C, depression, anorexia, muscle soreness and generalized weakness.

As part of the control measures that were enforced, all public horse events were cancelled in mid-October, with affected premises placed under quarantine. A four-day countywide ban on all horse movements was imposed November 7. Vaccination was not carried out and treatment of affected horses was not considered necessary in the majority of cases. The official date the occurrence of equine encephalosis was resolved was December 1, 2008.

Equine encephalosis virus and other Equine Orbiviruses : Current status and diagnostic RT-PCR assay development.

Peter Mertens S. Maan, K. Nomikou, K. Bankowska, A.C. Potgieter, H. Attoui, A. Samuel, N. Maan, *Vector Borne Diseases Programme, IAH, Pirbright, UK Biochemistry Division, OVI, Onderstepoort, South Africa*

Since 1998 at least 15 different incursions of bluetongue have occurred in Europe, involving 12 different strains of 9 different BTV serotypes. These outbreaks (particularly those caused by BTV-8) have killed large numbers of animals mainly sheep and cattle, and have been linked to climate change in the region. Molecular epidemiology studies confirm that these viruses arrived in Europe (likely in the form of wind-borne infected midges) via several different routes (via Turkey into Greece and Bulgaria; From North Africa into Italy, the western Mediterranean Islands or Iberia; and via an unknown route directly into northern Europe).

Recent events (in 2007-2009) involving the equine orbiviruses, have included outbreaks of African horse sickness (AHSV types 2 and 7 in Senegal and Mauritania; AHSV-4 in Kenya) and Equine encephalosis (EEV – untyped, in Israel). In view of the recent European outbreaks of BTV these viruses

(which are also transmitted by *Culicoides* biting midges) must also be considered as a significant risk to animal health in the region.

Isolation and characterisation of the mosquito transmitted Peruvian horse sickness virus (PHSV) in South America and Australia (Attoui et al J. Virol in press) suggest that it could emerge to threaten new territories, possibly also linked to climate change.

As part of strategies to help deal with these threats, the full genomes of available virus strains (including all of the reference strains) of the equine orbiviruses were sequenced. These data have supported the development of novel serogroup/virus-species specific diagnostic real-time RT-PCR assays for AHSV, EEV and PHSV, targeting the conserved polymerase and helicase genes (Seg-1 and 9).

RT-PCR assays have also been developed for the different AHSV serotypes (which were used to identify recent outbreaks in Kenya and Senegal/Mauritania) targeting genome segment two (encoding the outermost capsid protein VP2). Type specific assays have also been developed for the seven EEV serotypes and for the single known type of PHSV.

Although these assays all work well with the virus strains currently available at IAH Pirbright (most of which were supplied by OVI in South –Africa) it will be important to maintain their validity, by testing them against further sequences and isolates of these viruses as they become available.

Emerging Diseases: Partnership between the Pharmaceutical Industry and Regulatory Authorities.

Danny Goovaerts, Intervet/Schering-Plough Animal Health

This presentation provided the industry perspective of responding to emerging diseases through vaccine production. The presentation addressed the current issues facing the industry including regulatory hurdles, capacity, marketing and working as partners with the regulatory agencies. When responding to an emerging disease, three main issues exist. There is a need for vaccines, ELISAs to differentiate vaccinated versus infected and also production facilities to handle the extra capacity needed.

In order to obtain a conditional license for a vaccine during emergency situations, the vaccine companies must submit a dossier with defined information about the product. During non emergency times, it can take 6 years to obtain licensure (2 years from time of submission of dossier to license). There are certain situations in which the conditional licenses are provided, The CVO has the authority to declare an animal health emergency. When Bluetongue broke in Europe, Intervet and other companies started developing vaccines one month after outbreak. The first license was given in 2007 and in 2008 a large vaccination campaign began. The conditional license was provided and this took a total of 14 months.

Issues that the vaccine company faces are that it is difficult to prepare a business case for the company for development of a vaccine for an emerging disease. The investment in R&D is often hard to justify. Volume cannot be predicted and the industry doesn't have idle factories waiting until an event happens. Conditional licenses are good for getting to market in short time, but still require complete licensure. Dr Goovaerts posed a series of questions including:

- what vaccines are attractive for a company to develop
- is there market potential
- what type of vaccine should be produced?

For some diseases, it may be better to produce antigens for a vaccine bank and keep them stored. Dr Goovaerts concluded by stressing the need for full partnership between industry, and regulatory authorities. A proactive instead of a reactive relationship would promote the development of vaccines for the control of epidemic diseases.

A Case of Novel H1N1 Influenza Virus in a Swine Herd in Alberta, Canada;

Dr. Jim Clark National Manager, Disease Control Terrestrial Animal Health Division Canadian Food Inspection Agency.

Dr. Clark reported that influenza A virus infections commonly occur in swine herds world-wide, including the North American swine population. Although human influenza viruses have been isolated from pigs, historically there has been varied evidence of human H1N1 influenza viruses maintaining themselves in swine population. Swine influenza virus infections, both H3N2 and H1N1, have been reported in humans in Canada, the United States, Europe and Asia. Occupational exposure to pigs increases the risk of sero-conversion and influenza-like illness (ILI) attributable to SIV. The reported

number of SIV infections in humans, however, is negligible compared to the number of people exposed to pigs through occupation or association. The true incidence and significance of zoonotic swine influenza infection in the animal or human populations is unknown.

On April 23, 2009, the Canadian Food Inspection Agency (CFIA) convened a High Visibility Issue meeting to consider the importance and relevance of information being reported from Mexico and the USA concerning a novel influenza A virus. According to a ProMED posting of April 21, 2009, "On 17 Apr 2009, CDC determined that 2 cases of febrile respiratory illness occurring in children who resided in adjacent counties in southern California were caused by infection with a swine influenza A (H1N1) virus. The viruses from the 2 cases are closely related genetically, resistant to amantadine and rimantadine, and contain a unique combination of gene segments that previously has not been reported among swine or human influenza viruses in the United States or elsewhere. Neither child had contact with pigs; the source of the infection is unknown". Additional information in the report indicated, "the viruses are similar to those of swine influenza viruses that have circulated among US pigs since approximately 1999; however, 2 genes coding for the neuraminidase (NA) and matrix (M) proteins are similar to corresponding genes of swine influenza viruses of the Eurasian lineage." Based on a lack of exposure to pigs in the histories of the infected individuals, there was concern that this virus could be transmitted human to human. Due to the unknown risks the virus might pose to swine or other animals, the CFIA mobilized its National Emergency Response Team to consider the potential risks and develop a policy to address the possibility the virus would be found in the Canadian domestic swine herd. Communication products were developed to provide information to the swine industry, veterinary community and agricultural officials in the provinces and territories asking they be vigilant for any influenza like illness in the swine population especially where there was a history of a person in contact with the swine that had influenza like illness (ILI) and a history of recent travel to Mexico or southern California. Initial policy development adopted a precautionary approach requiring federal quarantine to control movement and testing the herd until virus circulation was no longer detected at which time the quarantine would be released. There was also discussion of the need for research trials to better define any disease caused by this novel virus in swine and poultry and determine the efficacy of the currently available commercial swine influenza vaccines.

Influenza (pH1N1) in pigs in Australia.

P.D. Kirkland, Virology Laboratory, EMAI, NSW

The swine population in Australia was presumed free of influenza viruses up to this year. In mid July of 2009, influenza like clinical signs were reported in a breeding herd in Australia. This coincided with epidemic of influenza in the human population. H1N1 virus was isolated on a 250 sow breeding farm. There were no other commercial pig farms within 50 km of this farm. Clinical signs included sudden onset of mild flu like illness. These clinical signs were noted 5 days after flu-like illness in worker had occurred. Clinical signs included coughing and pigs of most ages affected. Nasal swabs and sera were collected. 13/13 pigs were found positive using a modified fluA matrix PCR test. 21/21 pigs were positive by serology. The owner of farm also became ill. The confirmatory laboratory in Gelong was sent samples for virus isolation but were unable to propagate virus. The farm was quarantined. When no clinical signs and if clear from infection for 7 days, pigs were then allowed to go to slaughter. There was good support from abattoir workers. In humans in Australia, the virus is causing mild clinical symptoms. Virus is easily spreading from humans to pigs, but it does appear that virus goes back the other way as well.

U.S. Swine Industry Response to Novel H1N1 Influenza A virus

Patrick Webb, National Pork Board

The U.S. pork industry continues to take a proactive approach towards managing the novel H1N1 event, which has caused significant economic repercussions to an industry already experiencing 21 months of financial losses. When news of the novel H1N1 outbreak in humans hit in late April, crisis management plans were ready to be put into action. These actions included rapid communications out to producers explaining the issues and actions they needed to take on the farm to better protect the U.S. swine herd.

To address the H1N1 outbreak in a comprehensive way, the National Pork Board joined with the National Pork Producers Council, the U.S. Meat Export Federation and the American Association of Swine Veterinarians to focus on four main objectives:

- To reassure U.S. consumers and America's international trading partners that U.S. pork is safe.

- To protect the U.S. swine herd from becoming infected with H1N1.
- To monitor the coverage of H1N1 by the media, social media, government and industry, and supply these organizations with science-based, accurate information.
- To be prepared to protect and defend the U.S. pork industry against unwarranted attacks and allegations.

As this event continued to unfold, the pork industry worked closely with USDA Animal and Plant Inspection Service, USDA Agricultural Research Service, Centers for Disease Control, State Veterinarians and State Public Health Officials to address research, surveillance and response issues.

The industry will continue to proactively address novel H1N1 issues. The U.S. pork producers are prepared to act in the best interest of the public, the animals in their care, their employees and their communities.

USDA Response to Novel H1N1 Influenza A virus.

Amy L. Vincent, DVM, PhD, Alessio Lorusso, DVM, PhD, Janice Ciacci-Zanella, DVM, PhD, Eraldo Zanella, DVM, PhD, Kelly A. Lager, DVM, PhD, Kay S. Faaberg, PhD, Marcus E. Kehrl, Jr., DVM, PhD* Swine and Prion Diseases Research Unit, National Animal Disease Center, USDA-ARS, Ames, IA.

Influenza A viruses are endemic in swine in most parts of the world. Swine influenza viruses in the U.S. have been very dynamic over the past 10 years - ever since the introduction of the triple reassortant internal gene cassette into swine influenza viruses. The predominant subtypes circulating in U.S. herds are H1N1, H1N2 and H3N2. The most prevalent isolates submitted to U.S. diagnostic labs over the past 3 years have been of the H1 subtype; within the H1 subtypes, the gamma, beta and delta hemagglutinin genetic cluster viruses are most commonly seen. Soon after the emergence of the H1N1 virus in April 2009, the team recognized the genetic origin of the pandemic virus H1 placed it in the gamma cluster of swine influenza viruses. ARS scientists at the National Animal Disease Center developed a research plan to investigate the pathogenesis and transmissibility of the pandemic virus in pigs. Before work began the team conducted a risk assessment and review of all protocols and permits required to work with this pandemic virus. After establishing the necessary laboratory safeguards (BSL2-enhanced) were in place, collaborators at the Centers for Disease Control and Prevention (CDC) shared pandemic viruses with the team. Immediate attention went to propagating the virus while developing 2 differential diagnostic tests (one RT-PCR and one gel-based RFLP) based on the novel matrix gene present in the pandemic virus, this work was completed the same day (01May09) that the team began inoculating pigs in a pilot pathogenesis study. The team also planned a larger pathogenesis/transmissibility study that began shortly thereafter. This first pig study was designed to evaluate whether the novel 2009 (A/H1N1) pandemic virus would infect, cause disease in and transmit between pigs. Unfortunately, this first study had to be abandoned as a result of discovering that the pigs had been infected with endemic SIV strains shortly before they arrived at our research facilities. These pigs were allowed to recover and were used in a later experiment. A second even larger pathogenesis/transmissibility study was then planned and executed, in this study the team doubled the number of pigs and used two separate pandemic virus isolates provided by the CDC. These studies quickly confirmed the pandemic viruses were pathogenic in pigs and readily transmissible between pigs. As part of these pathogenesis studies, it was confirmed that the novel 2009 (A/H1N1) pandemic influenza virus was only isolated from tissues associated with the respiratory tract in acutely infected pigs and that pigs quickly recover from the infection. The team then turned our attention to whether pigs previously infected with an endemic H1N1 swine influenza virus circulating in the U.S. pigs could protect against the 2009 (A/H1N1) pandemic influenza virus and it was found that pigs from our abandoned study that had recovered from a circulating endemic swine influenza virus appear to have complete cross-protection against subsequent challenge with the pandemic virus. Finally, 3 commercial vaccines were selected for efficacy testing against the pandemic virus based on serological cross-reactivity of vaccine antisera in a hemagglutination inhibition assay using 2009 A/H1N1 influenza viruses isolated from persons in California, New York, and Mexico. Results showed that in spite of limited cross reactivity against the new 2009 A/H1N1 influenza viruses the 3 vaccines tested each provided significant protection against pneumonia lesions in pigs challenged with a 2009 (A/H1N1) pandemic influenza virus. The most optimal protection was seen with an inactivated vaccine made from the homologous pandemic virus. Importantly, none of the vaccines tested caused disease enhancement in the lungs as is sometimes observed when the challenge virus is a mismatch with the vaccine virus strain. The team has also tested an experimental MLV vaccine and will continue research to develop new

vaccines that afford the best degree of heterologous protection possible against endemic swine influenza viruses.

An African Perspective on Novel H1N1 Influenza A virus and HPAI H5N1.

Linda Logan presented by John Shaw, USDA, International Services

APHIS IS is covering 25 countries in west and central Africa. This presentation related to the work on the prevention and control of animal influenzas. APHIS IS performs and sponsors diagnostic training. They are very involved in trying to consolidate poultry and producer groups with a focus on controlling disease in the live bird markets (LBMs) which are very important in this region. APHIS IS holds workshops in the host countries and also training in the USA.

What are the H5N1 HPAI threats to Africa? Egypt has a persistent problem with H5N1 whereas in sub-Saharan Africa there have been no new outbreaks since 2008. Studies indicate 3 separate introductions of H5N1 viruses to Africa. There is a lack of adequate surveillance and capacity in the region and there is a large gap between animal health and public health. There are logistical issues—especially shipping of samples to reference laboratory.

Avian Influenza and H1N1 Research Update.

David E. Swayne, Erica Spackman, Mary Pantin-Jackwood, Darrell Kapczynski and David L. Suarez, USDA, SE Poultry Research Laboratory.

Beginning in April 2009, cases of acute respiratory disease were reported in humans caused by a novel H1N1 influenza A virus in Mexico. The causative agent was complex reassortant influenza A virus with gene segments from North American classic H1N1 swine viruses, North American avian viruses, human influenza A virus and Eurasian H1N1 swine viruses. The presence of avian and swine influenza virus genes in the 2009 novel H1N1 virus raises the potential for infection in poultry following exposure to infected humans or swine. To study infectivity and transmissibility of the 2009 novel H1N1 strain in poultry, turkeys, chickens, domestic ducks and Japanese quail were intranasally challenged with the virus and naïve birds put in contact. No clinical disease was produced. Detection of virus replication was infrequent, and only in the oropharyngeal swabs of intranasally inoculated Japanese quail. There was no contact transmission of the viruses for any of the species. These data suggest turkeys, chickens, and domestic duck have low risk for field infection, but Japanese quail might become infected, but because replication and shedding was limited to the respiratory tract and the virus did not transmit to quail by contact, suggested low potential for initiation and sustaining an outbreak unless the virus mutates or reassorts with an avian influenza virus.

Sporadic cases of H5N1 have occurred in pigs and various carnivorous mammals. To understand the route of transmission that oral ingestion might play and the pathogenesis, several H5N1 HPAI viruses were studied in pig and ferret models. Intranasal inoculation produced infection, initiated in the respiratory tract in both pigs and ferrets. Feeding of infected chicken meat to pigs produced asymptomatic infection with virus present in tonsil and respiratory tract but not in the digestive tract. By comparison, 2 H5N1 viruses in infected chicken meat fed to ferrets produced only respiratory infection while the A/Vietnam/1203/04 virus produced a combined respiratory and digestive tract infection, initiated simultaneously in both sites.

The chicken's major histocompatibility complex (MHC) and non-MHC genes have a profound influence on the resistance or susceptibility to certain pathogens. Recently, 100% survival in the field by Thai indigenous chickens to H5N1 high pathogenicity avian influenza (HPAI) outbreaks was attributed to B21 MHC haplotype while the B13 MHC haplotype was associated with 100% mortality in the field. To determine the influence of the MHC haplotype on HPAI resistance, a series of MHC congenic white leghorn chicken lines (B2, B12, B13, B19 and B21) and lines with different background genes but with the same B2 MHC haplotype (Line 63 and 71) were intranasally challenged with low dose (10 mean chicken lethal doses) of H5N1 HPAI virus rgA/chicken/Indonesia/7/2003. None of the lines were completely resistant to lethal effects of the challenge as evident by mortality rates ranging from 40 to 100%. The B21 line had mortality of 40% and 70% and the B13 line had mortality of 60 and 100% in 2 separate trials indicating the Thai field results could not be the result of MHC differences.

Ebola virus (Reston) in swine in the Philippines.

Samia Metwally, Foreign Animal Disease Diagnostic Laboratory (FADDL), USDA- APHIS.

Dr. Metwally described how Ebola Reston was diagnosed in swine in Philippines. In 2008, swine began dying with high fever syndrome from which PRRS virus had been isolated. FADDL was contacted early in 2008 and by the end of July they got samples to Plum Island. Samples were accepted with minimal history. Based on the history and clinical signs, FADDL designed a diagnostic scheme to look for African Swine Fever, Classical Swine Fever, PRRS, Circovirus, Porcine enterovirus, and other rule outs. Samples were set up on 6 different cell lines. If samples were positive for virus isolation they were moved on for further identification. Electron Microscopy was utilized and if there was no virus found by EM, then the samples were moved on to microarray and sequence analysis and animal inoculation. These samples tested negative for ASF and CSF. PRRS was isolated and it was similar to that isolated in China with deletion that is characteristic of the virus that is spreading in Asia. The samples were also examined using a panviral microarray. This is a new technology that was developed in FADDL laboratory which indicated that the samples contained an Ebola virus. Subsequently conventional PCR was performed and bands were specific for Ebola Reston. The CDC was contacted and FADDL provided information to them. CDC confirmed the diagnosis of Ebola Reston infection of the pigs. The significance of the infection is being investigated further. There is no evidence that pigs in the Philippines are currently infected

Classical Swine Fever (CSF) and other diseases of pigs in the Caribbean Region.

John Shaw, International Services, USDA-APHIS

Dr Shaw described a working group that is emerging in the Caribbean. He described the situation with CSF in Cuba which currently has a swine population of 2.5 M pigs. They had 193 outbreaks of CSF last year. The disease is reportable and controlled by vaccination. CSF is also present in Haiti and to a lesser extent in Haiti. The Haitian authorities also reported an outbreak of Teschen virus infection, the origin of which is unknown.

Rift Valley Fever: International Coordinated Efforts from Early Warning to Rapid Responses.

William Wilson, Kristine Bennett, James Mecham, Myrna Miller, and Barbara Drolet, USDA, ARS, ABADRL

Scientists at the USDA, ARS, Arthropod-Borne Animal Diseases Research Laboratory (ABADRL) initiated research to develop operator-safe, rapid diagnostic tests and develop large animal models for both virulent and vaccine strains of Rift Valley Fever (RVF). The ABADRL currently does not have biological containment facilities that could be certified for virulent RVF research. Therefore, to accomplish this research mission, the ABADRL has relied on molecular applications and has established national and international cooperative agreements. The ABADRL and the Canadian Food Inspection Agency (CFIA) have been working together to develop clinical diagnostic test samples and a large animal infection model for vaccine evaluation. To date, six experimental virulent RVF infection studies with calves (four) and sheep (two) have been conducted at the CFIA laboratory. In addition, in the ABADRL BSL-2 facilities, three RVF MP-12 vaccine studies have been conducted in sheep. These studies have provided samples and reagents for ARS scientists and collaborators to develop of operator-safe BSL-2 diagnostics tools. One of these tools is a multiplex real-time RT-PCR that detects all three segments of RVF viral RNA and can distinguish between wild-type and several candidate attenuated vaccine strains. This assay was field tested at the Kenya Agriculture Research Institute and Kenya Department of Veterinary Services. The results indicated that some modifications were required, but overall the assay performed well, did not cross-react with Nairobi sheep disease virus and was more sensitive than existing nucleic acid detection assays. Immunological assays based on expressed glycoprotein (Gn), nucleocapsid (N) and Nonstructural protein (NSs) have also been developed and laboratory evaluated. International cooperative agreements are in place to allow for field evaluation of these diagnostic tests and of candidate RVF vaccines. The FAO/IAEA Animal Health and Production division has a coordinated research project of RVF veterinary surveillance in which ABADRL scientists participate as consultants. These interactions, along with the assistance of USDA, APHIS, will allow the development of internationally harmonized diagnostic tools for RVF in North America.

The ABADRL is also developing a RVF vaccine discovery project. In order to better evaluate RVF vaccine candidates, the ABADRL has been evaluating various tools to assess the humoral and cell-mediated immunity responses of sheep. The ABADRL, in collaboration with the U.S. Army Medical Research Institute for Infectious Diseases and CFIA, are evaluating the vector competence of North American mosquito species for infection and transmission of RVF virus. The West Nile virus vector,

Culex tarsalis has been shown to be a competent vector for RVF. In addition, the origin of populations of *Aedes vexans* has been shown to affect this species vector competence. Thus, to effectively control the spread of RVF, knowledge of competence of geographic populations of vector species is needed. The ABADRL is working with ARS scientists at the Center for Medical, Agricultural, and Veterinary Entomology (CMAVE) have developed a Risk Assessment Model for RVF outbreaks in East Africa. ABADRL and CMAVE are coordinating insect vector research to further improve this model and develop vector control strategies. ABADRL, CMAVE, DHS, APHIS, CDC and various universities are coordinating research activities in a "One Health" approach through a voluntary Interagency RVF working group, which was established to facilitate and coordinate U.S. research efforts. In summary, RVF is of significant concern in Africa and poses a significant threat to the US due to importations and globalization. The goal of these internal and international collaborations is to develop systems for early warning, early detection and more rapid and effective responses to this devastating disease. International cooperation is both mutually beneficial, and essential, in order to adequately evaluate the veterinary RVF countermeasure tools. ARS believes one of the most effective US countermeasures for the potential introduction of RVF is to provide tools to control the disease at its source.

Rift Valley Fever: a multi-agency test of Florida's response to an hypothetical introduction to the state.

Paul Gibbs, College of Veterinary Medicine, University of Florida

Dr. Gibbs reported that Rift Valley fever (RVF) is a zoonotic viral disease affecting ruminants and people. It was first recognized, as the name suggests, in the Rift Valley of East Africa, but it now recognized to be an endemic disease affecting most of Sub-Saharan Africa and Madagascar. Since 1970, on occasion, it has shown an ability to spread northwards to cause epidemics in Egypt, Yemen, and Saudi Arabia. It is considered an emerging pathogen. The disease in most humans is characterized by fever and malaise, but a small percentage of patients develop either fatal encephalitis and/or generalized hemorrhage. In ruminants, the disease is particularly severe in lambs and calves, which die of generalized hemorrhage; pregnant animals commonly abort. RVF virus is transmitted by several species of mosquito, but human infection is often associated with the slaughter of infected animals for food. Experimental studies have established that US species of mosquito can transmit the virus, and the RVF virus is classified as a select agent. It is feared that RVF virus, if introduced accidentally or through bioterrorism, could have an even greater impact than West Nile virus on the animal and human populations of North America.

In partnership with the State's Emergency Operations Center, a multi-agency exercise (State and Federal) was organized to test the Florida's response to a simulated outbreak of RVF in both ruminants and humans. The exercise involved approximately 100 professionals November 18-20, 2008. The outbreak was characterized by increased calf mortality and mild human cases on a large ranch in Southern Florida. A case of hemorrhagic fever in West Palm Beach was connected to the slaughter of goats, and a case of retinitis in Gainesville, FL was connected to the initial introduction of the virus. The introduction of virus to Florida was linked to a bioterrorism event. Dr Gibbs described the scenario and discussed the difficulties met by the different agencies in combating the spread of the virus and determining its origin.

ARS Research Update 2009:

Luis L. Rodriguez, USDA-ARS Foreign Animal Disease Research Unit, Plum Island Animal Disease Center

Dr. Rodriguez reported that during 2009 ARS-FADRU has continued working on basic and applied research focused on foot-and-mouth disease, classical swine fever and vesicular stomatitis. There are 4 research projects:

- Foot-and-Mouth Disease Virus Countermeasures Discovery, Lead Scientist: Marvin Grubman;
- Foot-and-Mouth Disease Virus Host-Pathogen Interactions, Lead Scientist: Luis Rodriguez;
- Prevention Control and Diagnosis of Classical Swine Fever, Lead Scientist: Manuel Borca and
- Vesicular Stomatitis Virus Host-Pathogen Interactions, Lead Scientist: Luis Rodriguez.

- 1- FMD vaccine discovery: We report the preliminary results of experiments using alternate delivery systems to improve FMD vaccine performance. Specifically we report the use of a needle-free device to deliver inactivated antigen FMD vaccine in an aqueous formulation to cattle. The results

suggest that transdermal delivery results in protection of cattle against challenge with FMDV. Furthermore, similar protection levels were observed with ¼ and even 1/16 volume of the standard vaccine dose. Utilization of transdermal delivery devices for FMDV allows for rapid vaccine delivery during emergency control, is safer and prevents the spread of infections without the need to change needles between animals.

- 2- CSFV novel live attenuated marker vaccine: we update the FED committee on the advance of the Classical swine fever live attenuated marker vaccine. Specifically we update on the development of proof-of-concept DIVA diagnostic tests for serological differentiation of infected and vaccinated animals and the positive identification of vaccine strains by real-time RT-PCR
- 3- Vesicular stomatitis (VS): report on the re-emergence of VS New Jersey serotype in the southwestern US (Texas and New Mexico). This small outbreak was diagnosed by APHIS NVSL by serology only (no virus isolation). The limited distribution of this outbreak could be a failed incursion of VSV into the southwestern US. Increased VS activity in northern Mexico could be related to this incursion.
- 4- Brief report on the status of the Global Foot-and-Mouth Disease Research Alliance (GFRA), current membership and new collaborative projects of PIADC with international GFRA partners.

National Veterinary Services Laboratories Update

Dr Beverly Schmitt reporting for Dr Beth Lautner, NVSL, USDA-APHIS

Dr Schmitt reported that they had recently moved into new facilities and she showed various photographs of the impressive buildings. The move took place over 8 weeks this summer with 654 employees moving from 3 locations in Ames. Dr Schmitt reported that the move had gone smoothly with no disruption of diagnostic services.

Transition of the LIMS is complete now. Customer can elect to receive reports by email or fax. The year was busy, with investigations into CEM, H1N1, and equine piroplasmiasis necessitating extensive laboratory support. The laboratories also identified bluetongue virus types 9 and 12 for first time in US. Among other things, Dr Schmitt also mentioned the development of an OIE twinning project in Brazil for avian influenza and NDV. She also described renovations to the new facility to put in wet lab for aquaculture activities and to provide support for viral hemorrhagic disease of fish. The activities at NVSL, Plum Island included the discovery of Ebola Virus in pigs in the Philippines (see above)

National Center for Foreign Animal and Zoonotic Disease Defense Update.

Neville P. Clarke, Texas A & M.

Dr Clarke, reported under 3 headings:

- *Enhanced Immunity to Exotic Animal Diseases Affecting U.S. Public and Animal Health and the National Economy* – Prevention of the introduction or rapid spread of exotic diseases through enhanced resistance is recognized as a high priority objective for reducing the impact of animal diseases that may trigger human pandemics, endanger livestock, and cause economic damage. An animal vaccine against Rift Valley fever virus, one of the priority select agents, has been developed from the MP12 antigen developed for human use and is currently moving to commercial production trials. This product is being enhanced in further research with a genetic marker that allows the immunity resulting from vaccination to be distinguished from that associated with active disease, thereby allowing immunized animals to safely move through interstate commerce. The second generation vaccine will be tested in sheep in the early part of 2010.
- *Rapid Detection of Infected Animals During Disease Outbreaks:* Rapid, accurate, and inexpensive tests for exotic disease that can be applied under field conditions provide the ability to distinguish animals infected with exotic disease from uninfected animals, thereby avoiding unnecessary culling of normal animals during the eradication process and maintaining continuity of operations and reducing economic losses. Early detection of infected animals drastically reduces the spread of disease and resulting economic impact. The FAZD Center has developed an effective, accurate, and economical strip test (similar to a home pregnancy test) that provides the ability to detect foot-and-mouth disease (FMD) and Rift Valley fever viruses in the field. This system is now being tested at the Plum Island Animal Disease Center against live FMD virus. Also in the pipeline at an earlier stage of development is the universal biodetection array system that is being tested for proof of concept. This system simultaneously detects both the organism

and the host response for 100-plus pathogens including select agents and commonly encountered infections.

- *Innovative Anti-Viral Products that Provide Greater Protection for Livestock* – The devastating effect of an outbreak of foot-and-mouth disease (FMD) is illustrated by the 2001 outbreak in the United Kingdom that led to \$11.5 billion in losses. Vaccination remains among the most effective strategies for protecting livestock during an outbreak. Unfortunately, the vaccine for FMD requires up to 10 days after administration to become effective. This lag time severely limits the efficacy of the vaccine because FMD is among the most contagious and destructive of animal diseases and the disease spreads widely before vaccinated animals are immune. The FAZD Center has developed an antiviral product (an immunomodulator) that is incorporated into the FMD vaccine being developed by the Plum Island Animal Disease Center that reduces the time to develop an effective immune response to vaccination from 10 days to 3 days, thus providing almost immediate protection until the induction of long-term immunity by the vaccine. Developed at UTMB, the anti-viral is undergoing tests at Plum Island Animal Disease Center.

Bioportal system for global surveillance of animal diseases; focus on Vesicular Stomatitis.

Andres Perez, University of California, Davis

Dr Perez reported that the BioPortal is a web-based system was developed by UC Davis (<http://www.fmd.ucdavis.edu/>) in response to recommendations of the Infectious Disease Informatics Working Committee; an interagency senior group organized in 2002 to develop IT needs for national and global infectious disease surveillance. The BioPortal (<http://fmdbioportal.ucdavis.edu/>), provides real-time or near real-time access to disease information, and offers tools for data searches, public or secure data sharing, visualization, and data analyses. The system is applicable for use at the state, and national, and international levels. Operation, maintenance, and development of BioPortal are supported through contributions of the users, which currently include NCMI, the University of California, the USDA/ARS, and the FAO. Capabilities of the BioPortal include:

- Integration and utilization of data from multiple sources with disparate and non standardized data formats. No standardized nomenclature required.
- Secure routing and analysis of one's own data.
- Data display using common tabular and graphic formats, maps, and Google Earth.
- Data display in spatial-temporal formats.
- Data downloaded in a comma-separated values (CSV) format.
- Creation of detailed, personalized custom queries of the data.
- Alert user when new data have become available.
- Display using phylogenetic analytical tools to display phylogenetic trees of isolates.
- Spatio-temporal phylogenetic analysis, displays, and visualization of molecular changes.
- Anomaly detection with user-defined rules to identify and display anomalies in disease cases.
- Analysis to assess presence of disease clusters.

Specific applications of the BioPortal to meet state, federal, or international needs can be developed through cooperative contract agreements with UC Davis. Potential collaborators interested in using the BioPortal, or willing to contribute to development or support, are encouraged to contact Drs. Andres Perez (amperez@ucdavis.edu), Preben Willeberg (pwilleberg@ucdavis.edu), or Mark Thurmond (mcthurmond@ucdavis.edu).

Sustaining global surveillance and response of emerging zoonotic diseases: Report of the Institute of Medicine/National Research Council.

Mo Salman Colorado State University

Dr Salman provided a written report. The Institute of Medicine and National Research Council conducted a study to address the global surveillance and response of emerging zoonotic diseases. The study was sponsored by U.S. Agency for International Development (USAID) A report of the findings from this study was recently released by Institute of Medicine/National Research Council entitles "Sustaining Global Surveillance and Response of Emerging Zoonotic Diseases". The report indicates the significant weaknesses undermine the global community's abilities to prevent, detect, and respond to potentially deadly species-crossing microbes, such as the pandemic H1N1 influenza virus. The report provides a detailed plan for establishing and funding a comprehensive, globally coordinated system to

identify novel zoonotic disease threats as early as possible so that appropriate measures can be taken to prevent large numbers of illnesses, deaths, and livestock losses.

The report emphasized the role of U.S. federal agencies -- particularly USAID -- in spearhead efforts to develop a comprehensive surveillance system and work with international partners to provide funding and technical assistance to build the expertise, equipment, and other components of the system. The report notes that species-jumping pathogens have caused more than 65 percent of infectious disease outbreaks in the past six decades, and have racked up more than \$200 billion in economic losses worldwide over the past 10 years,. The U.S. beef industry alone lost \$11 billion over three years after the detection of one cow with "mad cow disease" in 2003.

Greater integration of the human health and veterinary medicine sectors should be a key feature of this new system because the lack of coordination and communication between these groups results in missed opportunities to detect potential species-crossing pathogens and leads to less effective measures to contain diseases. The report also recommends a fundamental shift in surveillance away from urgent, time-constrained reactions to individual diseases when they arise to a sustained focus on preventing the conditions for zoonotic agents to emerge and looking for signs of possible threats on an ongoing basis.

USAID should also lead an effort to identify sustainable funding sources to develop and maintain this new system. Funding for surveillance traditionally has focused on individual diseases with disproportionate resources aimed at infections in humans compared with those in animals. Moreover, development aid budgets tend to fluctuate with changes in leadership or priorities. The effort to find sustainable funding should specifically consider a tax on internationally traded meat and meat products as one possible mechanism; although the pros and cons of all options must be weighed to determine which funding sources will work best, the report notes.

The U.S. government and other donor organizations should provide economic incentives and technical and medical assistance to encourage the reporting of outbreaks and to lessen the social and economic consequences. Repercussions such as drops in trade and tourism and necessary culling of livestock can lead individuals and nations to conceal outbreaks.

In addition, the report calls for the director general of the World Organization for Animal Health (OIE) to have the power to declare animal health emergencies and make public credible information it receives about animal disease outbreaks if national governments fail to provide information in a timely manner. Greater transparency could improve control of animal diseases before they decimate livestock or wildlife or make large numbers of people sick.

The committee that conducted this study was composed of co-chairs Gerald T. Keusch, associate provost for global health and associate dean for global health, School of Public Health, Boston University, Boston and Marguerite Pappaioanou, executive director, Association of American Veterinary Medical Colleges, Washington, D.C. Committee members include several USAHA active members. The report can be reviewed through the following website: <http://nationalacademies.org/morenews/20090922.html>.

Global Approaches to Foot and Mouth Disease (FMD)

Dorothy Gaelle, Canadian Food Inspection Agency

Dr Gaelle gave an overview of the challenges of surveillance for FMD and the role of vaccination in different continents related to the FAO/OIE progressive control pathways. She reported that control of FMD on some continents will be difficult within the proposed time frame, but in others, such as Asia and South America, this may be feasible.

Distribution of Foreign Animal Disease Training Report 2008-2009

Paula Cowen, Professional Development Staff, USDA

Dr Cowen provided an illustrated overview of the current and extensive foreign animal and emerging disease training courses provided by USDA APHIS Professional Development Staff.

Committee Business

The Committee reviewed and approved a resolution namely to enhance development of risk assessment models by determination of United States wildlife susceptibility to Rift Valley fever virus.

The Committee recommended that USAHA join the Global Foot-and-Mouth Disease Research Alliance as described under Presentation 15 above.

The Committee noted that the last clinical case of rinderpest had occurred in Somalia in 2001. The Global Rinderpest Eradication Programme (GREP) was thus on target to recognize eradication in 2010

as originally intended. After discussion, the committee charged the chair to propose to the Executive Committee of USAHA, that the achievement be celebrated at the 2010 meeting in Minnesota.

A CASE OF NOVEL H1N1 INFLUENZA VIRUS IN A SWINE HERD IN ALBERTA, CANADA

Jim Clark
Disease Control Terrestrial Animal Health Division
Canadian Food Inspection Agency.

In March 2009, the world became aware of the existence of a novel H1N1 virus that was circulating in the human populations in Mexico and the southern USA. The genetics of that virus were determined to be those historically associated with a triple reassortant H1N1 swine influenza A virus that has occurred in the North American swine population since the late 1990's with the addition of Eurasian swine genetics on the matrix and neuraminidase genes.

Questions related to the risks this novel virus represented for animal populations lead to widespread communication to the veterinary and swine production communities in Canada for the need for enhanced awareness and reporting in the swine industry. The Canadian Food Inspection Agency was advised in late April 2009 of a swine herd in Alberta with a history of influenza-like illness and contact with an individual with a travel history to Mexico and subsequent influenza like illness following his return to Canada. CFIA imposed a precautionary quarantine and investigated the herd. Initial testing of nasal swabs using rtPCR with a standard primer for the matrix gene produced negative results. Subsequent testing using conventional PCR primers obtained from the National Microbiology Laboratory indicated the presence of an influenza A. Sequencing methods demonstrated a H1 subtype with 99% homology to the matrix gene in the novel H1N1 strain. Sequencing of the neuraminidase gene indicated homology with the neuraminidase gene of the novel H1N1 virus. A novel H1N1 influenza A virus was isolated from the samples submitted from the swine herd. On May 15th, the CFIA reported that the full sequence of the virus indicated that the virus found in the pigs was the same as the virus causing illness in humans around the world.

The CFIA developed a strategy/approach/plan to resolve the animal health issues associated with this farm, in line with the public health concerns. Public health and animal health authorities, nationally and internationally, were engaged in discussion. All groups and organizations supported the controlled marketing with no cull approach which the CFIA advocated. Crowding conditions in the barn forced a limited cull of approximately 500 mature hogs to alleviate animal welfare concerns and to allow a period of time to do testing in the herd. The hogs were euthanized using penetrating captive bolt pistols and transported to a rendering establishment. The rendered material was buried in landfill due to concerns about negative public perception of incorporating the end product into animal feeds.

Tests on samples collected on May 14 and May 25 showed evidence of continued virus presence.

The preliminary results of research to determine the virulence of the novel H1N1 virus for animals and the associated risk indicates the novel virus produces clinical signs similar to the seasonal swine influenza A viruses. The initial risk management decisions in this herd were precautionary due to the lack of information to determine the risk to the swine and human populations of North America and suggested a virus negative test on the entire herd was needed to release movement restrictions. As additional information became available that provided insight to the risk this virus posed for the human and animal community, it became difficult to modify the initial precautionary approach for several reasons including low risk tolerance by public health authorities.

Slaughter facilities were unwilling to take the hogs from this location and therefore the producer was able to convince government of the need to provide him with financial assistance to destroy the herd and allow him to resume operation with a replacement herd.