

REPORT OF THE COMMITTEE ON PUBLIC HEALTH AND RABIES

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The Committee met on November 8, 2005, from 8:00 am to 12:30 pm in Crystal A at the Hershey Lodge and Convention Center, Hershey, Pennsylvania. A total of 43 people attended the meeting including 11 committee members.

The first speaker was Mike Dunbar, National Wildlife Research Center (NWRC). He presented information on infrared thermography to detect rabies infection in raccoons. We evaluated infrared thermography as a technique to determine if raccoons (*Procyon lotor*) experimentally infected with rabies virus could be differentiated from non-infected raccoons and raccoons non-experimentally infected with canine distemper virus. Following a 10 day adjustment period, six raccoons were infected with a virulent street strain of raccoon rabies virus variant by injection into the masseter muscle with 2×10^4 tissue culture infectious dose (TCID₅₀)/ml ($n = 4$) or 1×10^5 TCID₅₀/ml ($n = 2$) of virus at day 0. Five of the six raccoons developed prodromal signs of rabies at \geq day 17 post-inoculation (PI) and clinical signs at \geq day 19 PI and tested positive for rabies virus. Twice daily, during the pre-inoculation and PI periods, infrared images of each raccoon were recorded using a Forward Looking Infrared camera. We found no apparent differences among daily thermal temperatures of the eye, average body surface, and temperature recorded from subcutaneous implants throughout the experiment for any of the six raccoons. However, differences were detected among the visual thermal images and among the average nose temperatures for the disease progression intervals. The mean (\pm SD) pre-inoculation temperature (22.0 ± 0.9 C) could not be distinguished statistically from that for the pre-prodromal stage (21.9 ± 1.0 C), but the succeeding disease stages were characterized by increasing temperatures. Prodromal temperature (23.3 ± 1.6 C) was elevated over pre-prodromal, and the temperature for clinical rabies (30.4 ± 3.5 C) was further elevated over the prodromal stage. In addition, the infrared visual images and surface temperatures of the nose of 10 raccoons non-experimentally infected with canine distemper virus were different from those infected with rabies virus and closely resembled temperatures of the noses of normal raccoons. This experiment provides data that indicates that infrared thermography can be used in an experimental setting to detect signs of rabies infection in raccoons.

Mike Dunbar also spoke on wildlife rabies research strategies at the NWRC. NWRC, located in Ft. Collins, Colorado, is the research arm of USDA's Wildlife Services (WS) program. The Wildlife Disease Research Program (WDRP) is one of four programs at the NWRC. Research conducted by scientists in the WDRP on rabies in wildlife is in support of the WS Oral Rabies Vaccination Program (ORV), whose goal is to eradicate rabies from terrestrial wildlife in the USA. The major objective of the ORV program is to prevent the westward spread of the raccoon strain of rabies from eastern states. The principle strategy to achieve this objective is to use an oral rabies vaccine (Raboral V-RG, manufactured by Merial, Ltd.), and use vaccinated raccoons as a barrier against further spread of the disease. To assist the ORV program in achieving this objective, research strategies at NWRC are focused on better understanding the ecology of wild mammals that may be susceptible to this or other strains, including the gray fox and coyote strains; developing and testing better baits for oral delivery of the Raboral V-RG vaccine; evaluate long-term vaccine efficacy; develop and test biomarkers to evaluate vaccine/bait uptake; conduct vaccine biosafety tests, especially in species not previously evaluated. Research studies conducted or funded by NWRC have identified a fishmeal coated sachet as the best, to date, vaccine/bait combination for raccoons; established the most efficient and cost effective baiting density for raccoons; evaluated baits for

skunks, should a vaccine be developed for skunks; recommended the best season of the year and habitat type to vaccinate skunks; conducting studies on long-term efficacy of the Raboral V-RG vaccine; identifying natural barriers to raccoon movements and dispersal; identified the commingling and interactive behavior of skunks that may allow rabies transmission in skunks and other wildlife as well as domestic pets; and a host of other information that is proving valuable to the ORV program. Scientists at the National Wildlife Research Center are committed to assisting programs that may eliminate rabies in the United States and North America.

Ciara O'Reilly discussed an outbreak of *E. coli* O157:H7 at a state fair in North Carolina in 2004. *E. coli* O157:H7 and other enterohemorrhagic *E. coli* (EHEC) infections cause hemorrhagic colitis and hemolytic uremic syndrome (HUS). An estimated 73,000 EHEC related infections and 61 deaths occur annually in the United States. Contaminated foods, beverages, water and livestock contact have caused outbreaks. In 2004, an *E. coli* O157:H7 outbreak occurred among North Carolina State Fair visitors.

We conducted a matched case-control study among fair visitors using randomly recruited controls who purchased tickets in advance. We defined cases as persons with culture-confirmed *E. coli* O157:H7 infection, HUS, or bloody diarrhea with illness onset after visiting the fair. Clinical specimens and environmental samples were tested by culture and pulsed-field gel electrophoresis (PFGE).

Of 108 reported cases, we enrolled 45 confirmed or probable case-patients and 188 controls in the case-control study. Median case-patient age was 3.2 years (range: 1-61). Thirty-six case-patients (80 percent) reported visiting the same petting zoo (Odds Ratio [OR]:7.7, 95-percent Confidence Interval [CI]:3.5-17.0). Among visitors to this petting zoo, illness was associated with stepping in or touching manure (OR: 4.9, CI: 1.9-12.8), falling or sitting on the ground (OR: 3.4, CI: 1.3-8.6) or contact with sheep or goats' front legs (OR: 2.5, CI: 1.03-5.9). Hand hygiene upon exiting the petting zoo was not protective (OR: 1.7, CI: 0.5-5.8). Of 38 patient isolates, 33 (87 percent) had indistinguishable PFGE patterns. Environmental isolates from the petting zoo area were indistinguishable by PFGE from these 33 clinical isolates.

In this study, most illnesses were associated with animal or manure contact in a single petting zoo. Hand hygiene was not protective. Contact with animals and manure in petting zoos should be restricted.

Mary Ann McBride provided a summary of efforts by the North Carolina Departments of Agriculture and Health to prevent future petting zoo-associated disease outbreaks.

Carina Blackmore presented a talk entitled, "*E. coli* O157:H7 outbreak associated with three petting zoos, Florida, 2005." A cluster of cases was reported and found to have commonality. One vendor supplied animals to the three fair petting zoos associated with the outbreak. Hemolytic uremic syndrome (HUS) cases and secondary cases were associated with this outbreak. Twenty-three cases were confirmed and 40 probable cases were reported. Fair A involved 37 animals (sheep, cattle, and goats). Animals from Fair A were divided up to exhibit at Fairs B and C. No positive environmental samples were found at Fair A. Fair A had a concrete exhibit area that had been disinfected. Positive environmental samples were found at Fairs B and C. Positive samples were isolated from animals in the petting zoos. Contact with the animals at the petting zoo at Fair B was limited and hand washing stations were available at the exit of the exhibit. Animal contact at Fairs A and C was more limited than at Fair B. Hand washing stations were available, though not at the exit of the exhibit. Risk factors in this outbreak were feeding a cow, touching a goat, feeding a goat, stepping in manure and drying hands on cloth. Protective behaviors were washing hands with soap and water and creating a lather and washing hands before eating. Hand wipes and hand sanitizers were not protective. This study showed that public education and easily accessible hand washing stations with paper towels are important to prevent disease spread.

C.E. Rupprecht Center for Disease Control and Prevention (CDC) and The Rabies Investigation Team discussed a recent occurrence of rabies transmission by solid organ transplant. During June 2004, U.S. recipients of kidneys, a liver and an arterial segment from a common organ donor developed fatal encephalitis of unknown etiology. Another recipient of the lungs died during transplantation surgery. Patients were from multiple locations, and medical records of the organ donor and recipients were reviewed during a multi-state investigation. Sera, cerebrospinal fluids and tissues from the recipients were tested by a variety of tests for numerous etiologies of encephalitis. Various samples from the

recipients were also inoculated into mice. The organ donor had been previously healthy before developing a sudden sub-arachnoid hemorrhage. All four recipients developed encephalitis within 30 days of transplantation. They experienced rapid neurological deterioration characterized by agitated delirium, seizures, respiratory failure and coma. Patients died an average of 13 days after the onset of symptoms. Animals inoculated with samples from affected patients developed illness after one week. Electron microscopy of Central Nervous System (CNS) tissues demonstrated Rhabdovirus particles. Rabies virus-specific immunohistochemical and direct fluorescent antibody tests demonstrated rabies virus antigens in multiple tissues from all recipients. Cytoplasmic inclusions consistent with Negri bodies were observed in CNS tissues of all recipients. Rabies virus-neutralizing antibodies were present in 3 of the 4 recipients and the donor. Interviews with donor contacts elicited a history of apparent bat bite. A rabies virus variant was identified, associated with insectivorous bats from the southern United States. During 2005, German investigators began a similar inquiry into deaths of organ recipients from a donor reportedly exposed to rabies in India. These recent epidemiological and laboratory investigations documented transmission of rabies virus from organ donors to multiple recipients. Such reports underscore the potential for zoonotic disease transmission through transplantation and highlights the challenges of preventing and detecting transmission of emerging pathogens.

Paul Ettestad presented a discussion of 1-year versus 3-year rabies vaccination protocols in New Mexico. In 1997, New Mexico underwent a review of laws and regulations. As part of this review, rabies vaccination regulations were reviewed. At the time, annual rabies vaccination was required. Skunk rabies does circulate in southern and eastern New Mexico. A recommendation for change from an annual vaccination protocol to a 3-year protocol was contentious among veterinarians. Arguments in favor of 3-year vaccination included less potential for adverse effects and reduced cost to owners. Arguments against a new protocol included 1) annual vaccination provides more protection, 2) annual vaccination enhances compliance with vaccination, 3) the negative impact of decreased income for rural veterinarians, especially, and 4) annual vaccination allowed for annual animal examination for other diseases. At the time, a change in vaccine protocol was not made. Six years later, in 2003, animal advocacy groups promoted legislation specifying that dogs and cats could not be vaccinated more often than every 3 years. The New Mexico Department of Health provided scientific perspective and supported having provisions for both 1-year and 3-year vaccination protocols. Veterinarians were supportive of making a change. Local ordinances can still be more restrictive than state law and some still require annual vaccination. Lessons learned from this experience include recognizing the need to involve veterinarians and animal groups early on and to promote good communication.

Dennis Slate provided an update on the rabies vaccination barrier program. The vision of the program is to eliminate terrestrial rabies. In 2005, Oral Rabies Vaccination (ORV) zones were located in west central Texas for grey fox rabies, along the Mexican border for canine rabies, and along the east coast for raccoon strain rabies. In 2005, about 11 million baits were distributed. Indian reservations are beginning to be addressed. In partnership, Centers for Disease Control and Prevention (CDC) and United States Department of Agriculture (USDA) utilized a real-time rabies mapping system to provide current rabies distribution information. Ohio was a focus for 2005. In 2004, a raccoon rabies case was found beyond the existing barrier. A contingency response was implemented. It is likely that rabies had existed in the area and surveillance was insufficient to detect cases. Alternative possibilities are translocation, barrier breach, or hitchhiking. Another activity in 2005 was use of a rapid immunohistochemistry test (RIT). In 2006, grey fox vaccination efforts will be enhanced to the south and efforts against raccoon strain rabies will continue. Production of sachet baits is being enhanced. Skunk strain rabies virus is being addressed. To date, seroconversion in skunks with current vaccines does not appear adequate. This is an active area of research. Translocation of raccoons remains a concern as does a trend of increased raccoon densities.

Tracey Lynn, USDA-APHIS-VS, discussed the National Zoonotic Disease Surveillance Working Group (ZDWG) and presented preliminary results of a communications survey conducted with state public health and agriculture veterinarians.

The ZDWG, initially formed in 2002, was reinvigorated in 2004 following the hiring of dedicated personnel within USDA and Center for Disease Control and Prevention (CDC). The ZDWG meets by teleconference monthly, and consists of representatives from the USDA, CDC, Food and Drug

Administration (FDA), United States Geological Survey (USGS), National Wildlife Health Center, the Southeast Cooperative Wildlife Disease Study, the National Assembly of State Animal Health Officials, and the National Association of State Public Health Veterinarians. The ZDWG identified four initial goals:

1. Identify needed elements and essential partners
 - Agriculture, public health, wildlife, zoological, others
2. Develop a system of communication and triggers for action
3. Identify roles and responsibilities, divide workload, reduce duplication
4. Incorporate zoonotic disease surveillance into existing systems

In part to inform Goal 2 above, the ZDWG coordinated a survey sponsored by USAHA. The objective of the survey was to assess communication and coordination between state agriculture and state public health veterinarians. The survey was made available online at a private website, with email invitations to all designated state agriculture and public health veterinarians. The survey consisted of both multiple choice and open-ended questions. Preliminary results indicated a 74-percent response rate, with responses from 42 states; for 21 states, responses were received from both the state public health and state agriculture veterinarian. Fifty-seven percent of respondents indicated that an event had occurred during the last 12 months demonstrating need for better communication; of those, 89 percent said communications improved after that event. In addition, 84 percent of respondents indicated that they partnered with the other agency for zoonotic disease surveillance.

Additional data analyses are planned, and the results will assist the ZDWG in identifying actions that may improve coordination of zoonotic disease surveillance, including identification of other essential partners, such as zoo animal and industry representatives. In addition, the federal agencies are developing a background document that identifies each agency's mission, jurisdiction and role in zoonotic disease surveillance and response, as well as potential areas for collaboration.

Last year's Resolution 6, A National Plan for Rabies Control in Wildlife, had a positive response from CDC and USDA-APHIS-WS. Don Lein suggested that this resolution be resubmitted with additional wording of "with the ultimate goal of eliminating rabies strains regionally and nationally." The motion was seconded. The motion passed and the resolution has been forwarded to the Committee on Nominations and Resolutions.

The Committee's proposed mission statement was reviewed. A suggestion was made to broaden the scope to include wildlife, agriculture and public health. A suggestion was made to broaden the scope to animal populations. A motion was made and seconded to accept the amended draft mission statement. The motion passed. The Committee Mission is:

The purpose of the Committee on Public Health and Rabies is to enhance public health and environmental quality for all animals, including humans. It provides a liaison with USAHA to livestock producers and handlers, private and public veterinarians and their organizations and agencies. It will encourage increased coordination among agriculture, wildlife and public health agencies in the detection, identification, prevention, control, and eradication of infectious and non-infectious diseases and conditions affecting animals and the common environment of animals and humans. With emphasis on facilitating communication and data sharing between the animal and human health communities to recognize emerging and re-emerging zoonotic diseases.

Mission Objectives:

1. Establish a forum for all zoonotic diseases, both existing and emerging problems. Create zoonotic subcommittees as needed.
2. Objectives related to rabies are:
 - i. to maintain an awareness of the animal rabies situation, primarily in North America but other portions of the world as well
 - ii. to assess its impact on all animals including livestock, wildlife, pets, and humans
 - iii. to monitor regulatory programs of various public and animal health agencies in North America

- iv. to develop program recommendations
 - v. to share information on new technologies pertaining to rabies
3. Assist in maintaining and developing healthy animal populations by improving the environmental quality through information for handling of hazardous wastes, recycling, disinfection in management and production.
4. Review and recommend programs as a committee or in conjunction with other committees in reducing and preventing disease agent transmission through foods or feeds of animal or poultry origin intended for consumption.
5. Promote education and training initiatives for livestock producers and handlers, and private and public practitioners in defining their role in maintaining and enhancing the public's health and environmental quality.

There was a suggestion to establish a subcommittee on zoonotic disease surveillance to coordinate with the National Zoonotic Disease Surveillance Working Group. A motion was made and seconded to establish this subcommittee. The motion passed.

Personal protective equipment (PPE) for highly pathogenic avian influenza (HPAI) was discussed. There does not appear to be a consistent and specific standard at this time. A motion was made and seconded to make this a charge to the new subcommittee on zoonotic disease surveillance. The expected outcome is a review of existing information and generation of a written document with findings and recommendations. The motion passed.

A Food Safety and Inspection Service (FSIS) issue relating to rabies testing of animals presented at slaughter with neurologic signs was raised. There was a suggestion that the issue be referred to the National Association of State Public Health Veterinarians (NASPHV) for information on follow-up protocols.

A resolution on a new BSL-3 laboratory at the National Wildlife Research Center was discussed. Don Lein indicated that the Committee on Diagnostic Laboratory and Veterinary Workforce Development would be submitting the resolution. There was a motion for the Public Health and Rabies Committee to co-sponsor the resolution. The motion was seconded and passed. The resolution was forwarded to the Committee on Nominations and Resolutions.

A second resolution supporting funding for research on infrared thermography was discussed. A motion to approve the resolution was made, seconded and passed. Resolution forwarded to the Committee on Nominations and Resolutions.