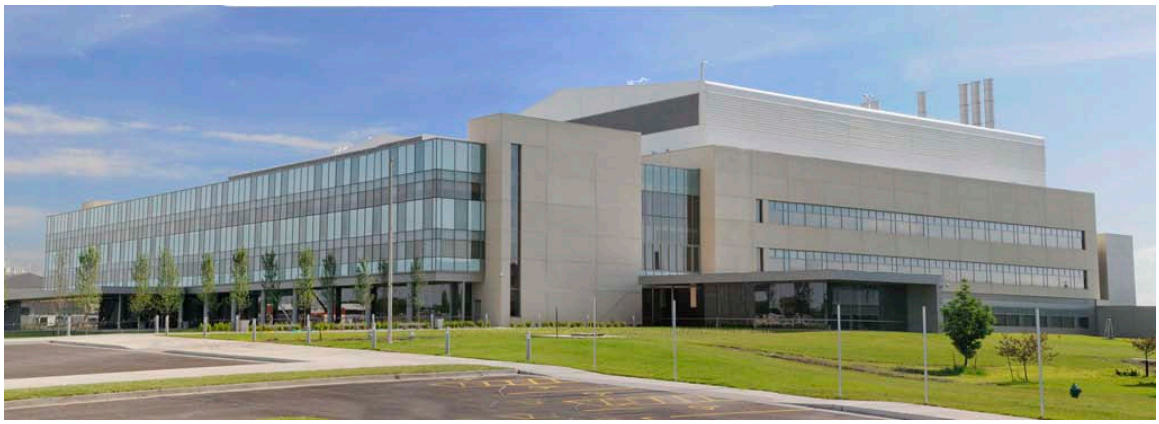
Chapter 4 – Diagnostics, Veterinary Biologics, and Disease Reporting

This chapter highlights the key 2009 accomplishments of APHIS' National Veterinary Services Laboratories (NVSL), Center for Veterinary Biologics (CVB), and the National Animal Health Laboratory Network (NAHLN). The chapter also describes some of APHIS' disease reporting functions, such as the National Animal Health Reporting System (NAHRS) and the online reporting of equine arboviral diseases.

The NVSL provides laboratory and diagnostic services for APHIS through its facilities in Ames, IA, and Plum Island, NY. The CVB, also headquartered in Ames, regulates veterinary biologics to ensure the safety and effectiveness of products used in animal disease prevention, diagnosis, and treatment.

Figure 4.1: New Facility in Ames, Iowa



In July 2009, NVSL and CVB moved into the new National Centers for Animal Health (figure 4.1). The facility is operated by USDA's Agricultural Research Service which also shares space with NVSL and CVB. The cutting-edge center provides laboratories, offices, animal space, and administrative space for some of the nation's top animal health scientists and researchers.

NVSL Highlights

NVSL highlights for 2009 include the following:

- **Outbreak Testing:** NVSL provided timely laboratory support to the significant animal health events of 2009, such as pandemic 2009 H1N1 influenza, contagious equine metritis (CEM), bovine tuberculosis (TB), and equine piroplasmosis, and experienced an overall increase in the number of samples submitted (193,000) for diagnostic testing. In the midst of outbreak

testing, NVSL also implemented molecular typing assays for *Taylorella equigenitalis* (the causative agent of CEM) and *Mycobacterium bovis* (the causative agent of TB). These assays provide key information for epidemiologists to determine the source and spread of infections.

- **H1N1 Virus:** NVSL collaborated with international scientists, researchers, and animal health authorities to validate and implement tests to differentiate pandemic 2009 H1N1 influenza from other circulating influenza strains and to coordinate influenza surveillance activities. NVSL personnel partnered with public health officials on the initial characterization of the new virus and investigated cases involving apparent transmission between humans and animals (swine, ferrets, cats, and cheetah).
- **Harmonizing Standards:** NVSL representatives continued serving on three working groups of the Security and Prosperity Partnership with Canada and Mexico. The objective of the groups is to harmonize (standardize) diagnostics for TB, avian influenza (AI), and vesicular diseases in North America.
- **Foreign Animal Disease (FAD) Investigations:** The Foreign Animal Disease Diagnostic Laboratory on Plum Island, NY participated in 79 FAD investigations. Selected FAD cases were successfully coordinated between NVSL-Plum Island and NAHLN laboratories in new joint testing procedures to provide increased rapid diagnostic testing.
- **New Rapid Screening Assays:** FAD investigations provided the opportunity to validate new rapid screening assays (panviral microarray) that simultaneously test for possible disease agents. The panviral microarray led to a collaboration with the U.S. Centers for Disease Control and Prevention (CDC) in the first-ever diagnosis of the Reston strain of Ebola virus in swine samples originating from the Philippines.
- **International Partnerships:** In its capacity as an international reference laboratory and collaborating center, the NVSL is routinely asked to provide expertise and assistance in global animal health efforts. In 2009, the NVSL, through the World Organization for Animal Health (OIE), entered into a "twinning" partnership with Brazil to provide training and expertise to increase Brazil's diagnostic capacity for AI and Newcastle disease. Personnel also participated in mission trips to Mexico, Haiti, and the Philippines to assist with the diagnoses of pandemic 2009 H1N1 influenza, porcine teschovirus encephalomyelitis, and Ebola-Reston virus in swine. The NVSL provided diagnostic assistance to Belize, Chile, the Dominican Republic, Haiti, Iraq, Mexico, Nicaragua, Nigeria, Pakistan, the Philippines, and Puerto Rico.
- **U.S. Federal Bureau of Investigation (FBI) Partnership:** The NVSL at Plum Island partnered with the FBI to standardize forensic procedures. As a member of the FBI forensic laboratory network, the NVSL assists with

criminal investigations involving samples that require the special biosafety and biosecurity facilities on Plum Island. NVSL-Plum Island also partnered with the U.S. Department of Homeland Security on several projects involving high-throughput diagnostics, multiplex assay development, and forensics.

- **Aquaculture:** Aquaculture diagnostics is a growing area of focus at the NVSL (an in vivo aquaculture facility is currently under construction). The NVSL provided expertise and testing for incursions of viral hemorrhagic septicemia into the Great Lakes area and participated in discussions of a possible U.S. aquatic health network.
- **Information Management:** A new laboratory information management system (LIMS) was implemented to track and manage diagnostic samples from receipt through final reporting. The new LIMS offers real-time release of test reports that may be delivered electronically by e-mail or fax. LIMS supports bar-coding technology and HL-7 messaging to exchange data with other animal health databases.
- **International Organization for Standardization (ISO) Accreditation:** In 2009, the NVSL renewed its accreditation to ISO 17025, an internationally recognized quality assurance standard. NVSL was originally accredited in 2006; however, the scope of accreditation was increased to include more than 140 testing protocols. The NVSL also became the first laboratory in the world accredited under new veterinary-specific standards.

2009 CVB Highlights

The CVB licensed a wide variety of novel products that are critical in the treatment, control, and diagnosis of existing, new, and emerging animal diseases. These products enhance the safety of the Nation's food supply, expand the marketability of exports, improve companion animal health, and enhance economic opportunities for agriculture.

- ***E. coli* vaccine:** Among these novel products is a vaccine to reduce *E. coli* O157:H7 in feedlot cattle. Designed to reduce the prevalence and shedding of *E. coli*, this vaccine provides an additional strategy for improving the health of feedlot cattle.
- **H1N1 Vaccine:** In response to the emerging threat of the pandemic H1N1 influenza virus to the domestic swine industry, the CVB took the unprecedented steps of acquiring, growing, and testing master seed viruses. The CVB provided these master seed viruses to interested veterinary biologics manufacturers for vaccine production. Because of this expedited process, an H1N1 vaccine with the pandemic strain was available at the end of the 2009 calendar year, reducing traditional product development timelines by an estimated 6 to 7 months. Additionally, it is estimated that this action saved the

veterinary biologics industry hundreds of thousands of dollars in development costs. The CVB also licensed the first canine influenza product to prevent the spread of an emerging interspecies influenza virus in dogs.

- **Veterinary Biological Serials, Inspections:** In 2009, the CVB released more than 15,000 veterinary biological serials (comprising more than 75 billion doses of vaccines and diagnostic kits) into the marketplace. In addition to product inspection activities, the CVB conducted more than 60 inspections of both domestic and international production facilities. These included in-depth inspections of licensed facilities for compliance with title 9, *Code of Federal Regulations* select agent inspections, observation of efficacy and duration-of-immunity studies, and special investigations. International cooperative agreement inspections involved production sites in Argentina, Australia, Czech Republic, France, Germany, Mexico, South Korea, and the United Kingdom.
- **Export Certificates:** The CVB processed more than 2,800 certificates of licensing and inspection for the export of veterinary biologics to promote safe agricultural trade and the continued marketing of U.S.-produced vaccines throughout the world. These certificates were processed within 14 or fewer working days. The CVB also processed approximately 1,000 export certificates. Many trading partners require these certificates prior to the importation of product into their countries. The CVB also ensured that there were no FAD events related to the importation of more than 84 million doses of veterinary biologics products into the United States.
- **International Standards:** The CVB continued its role as a partner in the development of international standards. Its continued involvement in the International Cooperation of Technical Requirements for Registration of Veterinary Medicinal Products led to the development of several new technical guidelines relating to target animal safety and post-license monitoring of product performance. Adoption and implementation of these international standards serve to increase trade with Japan and the European Union. At the OIE Region of the Americas Committee on Veterinary Medicines Seminars, the CVB participated in discussions on the implementation of harmonized standards for veterinary products. Additionally, the CVB presented general U.S. licensing requirements regarding stability in a joint workshop with the U.S. Food and Drug Administration. In 2009, the CVB continued its commitment to consistency, standardization, and predictability in its business processes by not only conforming to existing ISO 9001 Standards (ISO 9001:2000), but exceeding program goals through successful certification to enhanced 2008 ISO Standards. CVB received this certification in 2009 for the third consecutive

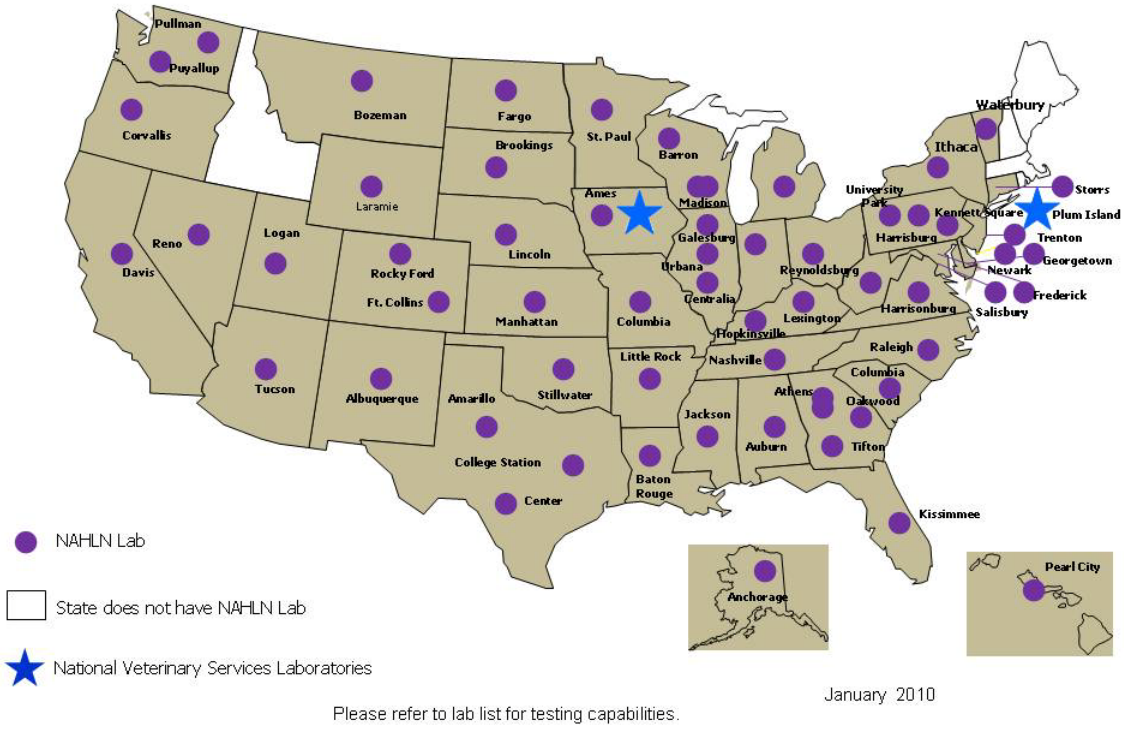
year. The certification provides external recognition that CVB business practices meet international standards for quality products, customer satisfaction, and process improvement.

- **Expertise and Training:** The CVB provided expertise and training at a joint CVB/Institute for International Cooperation in Animal Biologics program designed to educate industry representatives and foreign officials, many from emerging markets, on U.S. regulatory processes. More than 160 delegates from 16 countries participated in this course. The CVB also provided instruction and expertise for the Iraqi Animal Health Association and the Taiwan AI Symposium.

National Animal Health Laboratory Network (NAHLN)

APHIS partners with veterinary diagnostic laboratories throughout the United States to ensure there is adequate diagnostic capacity and capability for early detection of, rapid response to, and recovery from, animal health emergencies. This includes emerging diseases and FAD agents that threaten the Nation's food supply and public health. NAHLN has grown from 12 laboratories in 2002 to 63 laboratories in 45 States (figure 1). The NAHLN is comprised of 59 State and university laboratories; the Department of the Interior laboratory in Madison, WI; the Food Safety and Inspection Service laboratory in Athens, GA; and the NVSL campuses in Ames, IA, and Plum Island, NY.

Figure 4.1: Geographic Locations of NAHLN Laboratories



NVSL conducts proficiency tests and trains the NAHLN member laboratories annually or semi-annually. These tests focus on standardized screening methods for the currently targeted diseases in the NAHLN: avian influenza (AI), exotic Newcastle disease, scrapie, chronic wasting disease (CWD), bovine spongiform encephalopathy (BSE), vesicular stomatitis virus, classical swine fever (CSF), foot-and-mouth disease, swine influenza virus (SIV), and pseudorabies virus (PRV). The NAHLN laboratories perform screening assays and forward any suspect or positive samples to the appropriate section of the NVSL, the national reference laboratory, for confirmatory testing.

2009 NAHLN Highlights

The NAHLN highlights for 2009 include the following:

- **Laboratory Checklist:** The NAHLN Laboratory Qualification Checklist was updated to ensure a clear understanding of quality requirements and to reflect changes in Veterinary Services (VS) Memorandum 580.4, which incorporated responsibilities of the NAHLN laboratories during a FAD investigation. The NAHLN Checklist will be provided to the laboratories annually for completion to increase and improve an understanding of NAHLN commitments.

- **Laboratory Review Process:** NAHLN program staff collaborated with the American Association of Veterinary Laboratory Diagnosticians (AAVLD) to establish a process to review NAHLN laboratories to ensure the development and implementation of a quality system consistent with AAVLD, OIE, and ISO standards. The review process was implemented in 2008, expanded in 2009, and site visits for 15 unaccredited laboratories were completed by December 2009. Standardized reports were provided to each audited laboratory that provided details regarding nonconformance and requirements to be completed to maintain NAHLN status. A corrective action process was also established and implemented to ensure that the causes of deficiencies are identified and addressed.
- **Laboratory Designation and Responsibilities:** The NAHLN has four laboratory designations: Adjunct Member, Contract Member, Member, or Core Member Laboratory. In 2009, the list of requirements was updated to further define each laboratory's designation roles and responsibilities within the network.
- **Follow-up to Tabletop Exercises:** APHIS conducted 38 tabletop exercises in 2008 to test its emergency response capabilities in response to a potential outbreak of highly pathogenic AI in the United States. Participating NAHLN laboratories sponsored the exercises from February to October 2008, and involved more than 700 participants representing 45 States and numerous Federal, State, and local agencies, as well as the poultry industry. A summary report was released in 2009 and has been used to identify gaps and to prioritize necessary actions. This report is available on the NAHLN Web site at www.aphis.usda.gov/animal_health/nahln/. Working groups formed in 2009 have developed and implemented plans to address the identified gaps.
- **Revisions to VS Memorandum 580.4:** VS Memorandum 580.4 outlines the procedures for investigating a suspected foreign animal or emerging disease incident. The memorandum describes the investigative responsibilities of Area Veterinarians-in-Charge, Foreign Animal Disease Diagnosticians, and the NVSL. In 2008, VS Memorandum 580.4 was revised to include the potential use of NAHLN laboratories in FAD investigations. Flow charts that detail the roles and responsibilities and cross-reference the Memorandum were developed in 2009 and will be provided to the NAHLN laboratories and other animal health professionals.
- **Surveillance Activities:** The NAHLN program has collaborated with other divisions in APHIS, such as Wildlife Services (WS), NVSL, the National Surveillance Unit (NSU), the National Center for Animal Health Programs (NCAHP), and the National Center for Animal Health Emergency Management to implement surveillance programs. In 2009, NAHLN

laboratories participated in surveillance programs for classical swine fever (36 laboratories), BSE (7 laboratories), CWD and scrapie (24 laboratories), SIV (36 laboratories), and wild bird AI (36 laboratories). Additionally, 11 laboratories collaborated with APHIS to initiate a pseudorabies virus surveillance pilot project.

- **NAHLN Information Technology (IT) System:** A critical function of the NAHLN is to standardize data, improve data quality, and maximize the efficiency of data transfer through the IT infrastructure and data repository. The NAHLN IT system has been developed with data messaging and standards to ensure that accurate and consistent diagnostic information is quickly and securely transmitted. Test results from the CSF surveillance program have been electronically and securely submitted through a Web-based system for more than 3 years. In August 2008, NAHLN laboratories began transmitting CSF test results through standardized electronic messaging. Currently, 29 approved CSF laboratories are receiving surveillance samples and 10 of those are sending test results electronically. The IT system for WS' wild bird AI surveillance module was activated in June 2009. Thirty-six laboratories approved for AI are receiving surveillance samples and 10 of those laboratories are sending test results electronically. Five laboratories have completed the necessary requirements and will be messaging in the near future.
- **Symposium:** The NAHLN organized and delivered a pre-meeting symposium for the June 2009 World Association of Veterinary Laboratory Diagnosticians in Madrid, Spain. The symposium focused on establishing and implementing veterinary diagnostic laboratory networks. Topics included: an overview of the U.S. laboratory network (NAHLN); quality assurance and accreditation; assay validation and harmonization; continuous performance assessment; proficiency testing/ring testing; secure communications and reporting system; the use of modeling to determine laboratory capacity; scenario testing; and AI wild bird surveillance in the United States.
- **American Veterinary Medical Association (AVMA) Session:** NAHLN personnel presented a session on laboratory networks and their impact on human and animal health for the "One Medicine" program at the 2009 AVMA meeting. Titled "How Does the Laboratory Aspect of Response and Preparedness Impact Human and Animal Health?" the presentation described the NAHLN, the role of AAVLD laboratories in monitoring animal health, laboratory response during an animal health emergency, quality standards and accreditation, and an overview of completed and upcoming tabletop exercises.
- **NAHLN Newsletter:** The first issue of *The NAHLN Quarterly*, an electronic newsletter to increase communication with stakeholders, was distributed to

NAHLN laboratory directors in February 2009. Since that time, subscriptions have increased to more than 950 and include laboratory directors, State animal health officials, APHIS staff, industry representatives, and other State and Federal representatives.

- **NAHLN Web Site:** The NAHLN Web site provides information on the organization, mission, and vision of the NAHLN, along with current lists and maps of approved NAHLN laboratories. Information on the NAHLN IT system, surveillance efforts, *The NAHLN Quarterly* newsletter, and other NAHLN-related publications are also available on the NAHLN Web site at www.aphis.usda.gov/animal_health/nahln/.

Disease Reporting

National Animal Health Reporting System (NAHRS)

The NAHRS gathers data from State animal health officials on the presence of confirmed OIE-reportable diseases in specific livestock, poultry, and aquaculture species in the United States. NAHRS is a joint effort of the United States Animal Health Association (USAHA), AAVLD, and APHIS. The system functions as part of a comprehensive and integrated animal health surveillance system and is coordinated by NSU.

The United States meets its OIE reporting obligations using a variety of sources, including the NAHRS, FAD reports, and national program disease surveillance reports. Appendix 2 lists the U.S. status of the occurrence of OIE-reportable diseases in the United States.

NAHRS is a voluntary, cooperative system for reporting animal diseases. In 2009, 48 States reported monthly disease information. States that do not participate in NAHRS are still required to report FADs and VS national program diseases to APHIS surveillance data systems. A NAHRS online reporting tool allows State animal health officials to complete monthly NAHRS reports using the Internet with the assurance of secure data transfer and information confidentiality. State animal health officials may also use the NAHRS online tool to view summary reports or past monthly reports. Data reported to NAHRS are validated by the States, NVSL, and NCAHP. Other sources of national animal health data also may be accessed for validation.

2009 NAHRS Highlights

The NAHRS highlights for 2009 include the following:

- **Enhanced Aquaculture Reporting:** In 2009, the NAHRS online reporting tool application included all OIE-listed aquaculture diseases of fish, mollusks, and crustaceans. VS and the NAHRS Aquaculture Working Group continue efforts to enhance national aquaculture disease reporting by defining NAHRS reporting criteria and developing case definitions for reportable aquaculture diseases.
- **Equine Infectious Anemia (EIA) Reporting:** In 2009, State EIA testing data were reported through the NAHRS online reporting module. Reporting of EIA testing data was also changed from fiscal year (September-August) to calendar year. The change was requested by the NAHRS Steering Committee in coordination with the USAHA Infectious Diseases of Horses EIA Subcommittee.
- **National List of Reportable Animal Diseases:** APHIS, in cooperation with USAHA, AAVLD, State animal health officials, and industry representatives, continues to work on developing a National List of Reportable Animal Diseases (NLRAD) and appropriate associated reporting criteria. An NLRAD would assist in supporting international trade, standardize reporting by States, assist in meeting obligations of OIE reporting, and improve zoonotic and endemic animal disease reporting.
- **Redesign of the NAHRS Web Home Page:** In 2009, NSU personnel redesigned and reorganized the NAHRS Web home page. The redesigned site, www.aphis.usda.gov/animal_health/nahrs/, provides easier access and additional information for State and Federal NAHRS participants and general users. The NAHRS home page also updates U.S. animal health status and provides summary information and links to related sites.

Equine Arboviral Web Reporting

APHIS provides weekly updates on the number of disease cases associated with West Nile virus and eastern and western equine encephalitis during the transmission season (approximately June through November) at www.aphis.usda.gov/vs/nahss/equine. In 2009, there were 276 equine cases of West Nile virus reported in 36 States, and 301 equine cases of eastern equine encephalitis reported in 18 States.

Equine arbovirus reporting is accomplished through collaboration with the CDC and State veterinary and public health officials. CDC provides arbovirus case information to APHIS from its ArboNET reporting system, an electronic-based surveillance and reporting system used to track and report arboviral activity. APHIS subsequently disseminates the equine case information weekly to State veterinary officials for their confirmation, and posts the confirmed data on the NAHSS Web site. The Web site was

developed at the request of the USAHA Infectious Diseases of Horses Committee and the American Horse Council. This site is intended to provide timely and accurate equine arbovirus case information to individuals associated with the horse industry, including horse owners, animal health professionals, and regulatory officials, as well as public health officials and those in related academic and research fields.