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Newcastle Disease

Exotic Newcastle Disease, Pseudo-Fowl Pest, Pseudovogel-Pest, Atypical Geflugelpest, Pseudo-Poultry Plague, Avian Pest, Avian Distemper, Ranikhet Disease, Tetelo Disease, Korean Fowl Plague, and Avian Pneumoencephalitis



Newcastle Disease has also been referred to as exotic newcastle disease, pseudo-fowl pest, pseudovogel-pest, atypical geflugelpest, pseudo-poultry plague, avian pest, avian distemper, Ranikhet disease, Tetelo disease, Korean fowl plague, and avian pneumoencephalitis.

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Overview

- Organism
- Economic Impact
- Epidemiology
- Transmission
- Clinical Signs
- Diagnosis and Treatment
- Prevention and Control
- Actions to take




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In today's presentation we will cover information regarding the organism that causes Newcastle disease and its epidemiology. We will also talk about the economic impact the disease has had in the past and could have in the future. Additionally, we will talk about how it is transmitted, the species it affects (including humans), clinical and necropsy signs seen, and diagnosis and treatment of the disease. Finally, we will address prevention and control measures for the disease as well as actions to take if Newcastle disease is suspected. (Photo: USDA-APHIS)

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The Organism



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Newcastle Disease

- Family Paramyxoviridae
 - Genus *Avulavirus*
- 9 serotypes APMV-1 to APMV-9
- Newcastle disease is APMV-1

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Newcastle disease viruses are in the family Paramyxoviridae, and genus *Avulavirus*. There are nine avian paramyxovirus serotypes designated APMV-1 to APMV-9. Of these, Newcastle disease virus, which is APMV-1, remains the most important pathogen for poultry, but APMV-2, APMV-3, APMV-6 and APMV-7 also cause disease in poultry.

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Newcastle Disease

- Four pathotypes:
 - Asymptomatic enteric - Subclinical
 - Lentogenic
 - Subclinical to mild respiratory
 - Mesogenic
 - Respiratory or neurological
 - Velogenic
 - Neurotropic: Respiratory or neurological
 - Vicerotropic: Hemorrhagic intestinal lesions


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Newcastle disease virus strains are grouped into pathotypes based on their clinical signs and increasing virulence. These include: asymptomatic enteric, which is generally subclinical; lentogenic, which has mild or subclinical respiratory signs; mesogenic, which has respiratory and occasional neurologic signs; and velogenic, which is the most virulent pathotype with high mortality rates. The velogenic pathotype is divided into a neurotropic form which has respiratory and neurologic signs and a vicerotropic form with hemorrhagic intestinal lesions.

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Newcastle Disease

- vND: virulent Newcastle Disease
 - Includes:
 - Mesogenic
 - Velogenic neurotropic
 - Velogenic viscerotropic



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The nomenclature used to describe ND is confusing, as sometimes infection of birds with any strain of the NDV may be termed ND. Less virulent strains may induce severe disease when exacerbated by the presence of other organisms or by adverse environmental condition. To avoid confusion, the abbreviation vND will be used in this presentation for the disease caused by the virulent strains of virus which includes mesogenic, velogenic neurotropic and velogenic viscerotropic strains. (Photo: USDA-APHIS)

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Importance



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History

- 1926
 - Java, Indonesia
 - Newcastle-upon-Tyne, England
- Probable earlier outbreaks in Central Europe
- 1896: Western Scotland, cause of death of all chickens?
- 4 panzootics from 1926 to 1981

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It is generally considered that the first outbreaks of vND occurred in 1926, in Java, Indonesia and in Newcastle-upon-Tyne, England. There are reports of disease outbreaks in Central Europe similar to what we now recognize as vND that predate 1926. The disease may have been the cause of death of all the chickens in the Western Isles of Scotland in 1896. 4 panzootics of vND are believed to have occurred from 1926 until 1981: 1926-1960's; 1960's to 1973; late 1970's, and late 1970's to 1981.

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History in U.S.

- 1950: First U.S. case
 - Partridges and pheasants imported from Hong Kong
- 1971-74: California outbreak
 - 1,321 infected and exposed flocks
 - 12 million birds destroyed
 - \$56 million dollar cost to tax payers
- Outbreaks in the U.S.
 - Due to illegal importation of exotic birds and poultry

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The first cases of Newcastle Disease in the U.S. were in the 1930's with outbreaks of pneumonencephalitis in California and by the mid-forties, the disease spread across the United States. The first case of vND occurred in 1950 in partridges and pheasants imported from Hong Kong. In November 1971 a major outbreak occurred in commercial flocks in southern California after the arrival of a shipment of infected pet birds from Latin America. In March of 1972 a national animal health emergency was declared and a major eradication campaign began. During the 2 year effort, 1,321 infected and exposed flocks were located and almost 12 million birds destroyed. The operation cost taxpayers approximately \$56 million. It wasn't until July 1974 that the U.S. had succeeded in eradicating vND. Frequent outbreaks of vND have occurred since in the U.S. due to illegal importation of exotic birds and poultry.

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History in U.S.

- 2002-2003: California outbreak
 - 2,662 premises depopulated
 - 4 million birds destroyed
 - \$160 million dollar cost



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In October 2002, vND was confirmed in the State of California. Cases occurred in Nevada, Arizona, Texas and New Mexico. As of July 7, 2003, with the epidemic in the final phase of eradication, almost 4 million birds on 2,662 premises had been depopulated. Eradication efforts have cost taxpayers \$160 million to date (July 2003). (Photos: USDA-APHIS from the 2002/2003 California outbreak)

S l i d e 1 1	<p style="text-align: center;">Economic Impact</p> <ul style="list-style-type: none"> • Global economic impact enormous <ul style="list-style-type: none"> – More costly than any other animal virus? – Continued control measures expensive – Repeated testing for trade purposes <p style="text-align: right; font-size: small;">Center for Food Security and Public Health Iowa State University - 2004</p>	<p>The global economic impact of vND is enormous. No other poultry virus comes close and it may represent a bigger drain on the world's economy than any other animal virus. In developed countries outbreaks of vND are extremely costly, and control measures, including vaccination, are a continuing loss to the industry. Countries free of vND are faced with repeated testing to maintain that status for trade purposes.</p>
S l i d e 1 2	<p style="text-align: center;">Economic Impact</p> <ul style="list-style-type: none"> • Developing countries <ul style="list-style-type: none"> – Effects quality and quantity of dietary protein – Significant effect on human health <p style="text-align: right; font-size: small;">Center for Food Security and Public Health Iowa State University - 2004</p>	<p>In developing countries with endemic vND this is an important limiting factor in development of commercial poultry and the establishment of trade links. Many developing countries rely on village chickens to supply a significant portion of dietary protein in the form of eggs and meat, especially for women and children. Continued losses from vND affect the quantity and quality of the food of people on marginal diets. The economic impact of vND is not only measured in direct commercial losses, but in some countries in the effect on human health.</p>
S l i d e 1 3	<p style="text-align: center;">Epidemiology</p> <p style="text-align: right; font-size: small;">  </p>	
S l i d e 1 4	<p style="text-align: center;">Geographic Distribution</p> <ul style="list-style-type: none"> • Endemic <ul style="list-style-type: none"> – Asia, the Middle East, Africa, Central and South America • Vaccine use makes assessment of true geographical distribution difficult • International monitoring <ul style="list-style-type: none"> – By the FAO and OIE <p style="text-align: right; font-size: small;">Center for Food Security and Public Health Iowa State University - 2004</p>	<p>vND is endemic in many parts of the world including countries in Asia, the Middle East, Africa, and Central and South America. Some countries in Europe are free of the disease. The United States and Canada have seen high mortality in wild cormorants caused by vND. The almost worldwide use of ND vaccines in commercial poultry makes assessment of the true geographic distribution of ND virus difficult. International monitoring of ND is carried out by the Food and Agriculture Organization of the United Nations (FAO) and the World Organization for Animal Health, formerly known as Office International des Epizooties (OIE), even so, figures produced may not represent the true distribution of vND.</p>
S l i d e 1 5	<p style="text-align: center;">Morbidity/Mortality</p> <ul style="list-style-type: none"> • Morbidity: Up to 100% • Mortality: 90% • Varies greatly depending on <ul style="list-style-type: none"> – Virulence and strain – Avian species and susceptibility of host – Environmental conditions – Secondary infections – Vaccination history • Some species show few or no signs <ul style="list-style-type: none"> – Carrier state may exist <p style="text-align: right; font-size: small;">Center for Food Security and Public Health Iowa State University - 2004</p>	<p>Morbidity and mortality rates can vary greatly depending on the virulence of the virus strain and susceptibility of the host. Environmental conditions, secondary infections, vaccination history and avian species all affect these rates. It affects both domestic and wild bird population. In chickens, morbidity can be up to 100% with 90% mortality. In other species such as finches and canaries, clinical signs may not be present. A carrier state may exist in psittacine and some other wild birds. Ducks and geese may be infected and show few or no clinical signs, even with strains lethal for chickens.</p>

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Transmission




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Animal Transmission

- Direct contact with feces and respiratory discharges
- Contamination of the environment
 - Feed, water
 - Equipment
 - Human clothing
 - Contaminated or incompletely inactivated vaccines



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Transmission can occur by direct contact with feces and respiratory discharges or by contamination of the environment including food, water, equipment, and human clothing. Virus is present in all parts of the carcass of an infected bird. The greatest potential for spread of the disease is by humans and their equipment. Implicated in various epizootics: movement of live birds, contact with other animals, movement of people and equipment, movement of poultry products, airborne, contaminated poultry feed, contaminated water and contaminated or incompletely inactivated vaccines. (Photo: USDA-APHIS, 2002/2003 California outbreak)

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Animal Transmission

- Survives for long periods in the environment
- Incubation period: 2-15 days
 - 5-6 days average
- Migratory birds, feral pigeons
 - Contamination of poultry feed

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Newcastle disease virus can survive for long periods in the environment, especially in feces. Generally virus is shed during the incubation period and for a short time during recovery. Some psittacine species can shed the virus intermittently for a year or more. The incubation period varies from 2-15 days (average 5-6) depending on the severity of the strain and susceptibility of the population. Migratory birds have been implicated in the primary introduction of the virus, with outbreaks the result of secondary spread by humans. Feral pigeons have also been implicated in the contamination of poultry feed.

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Human Transmission

- Mild conjunctivitis
 - Virus shed in ocular secretions for 4-7 days
 - Avoid contact with avian species during this time
- Lab workers and vaccination crews most at risk
- No cases from handling or consuming poultry products
- No human-to-human spread


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People can become infected with vND and have signs of conjunctivitis which resolves quickly, with virus being shed in ocular discharges for 4-7 days. Infected individuals should avoid direct and indirect contact with avian species during this time as it may pose a mode of transmission. Laboratory workers and vaccination crews are most at risk, with poultry workers rarely being infected. No known infections have occurred from handling or consuming poultry products.

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Animals and
Virulent Newcastle
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Clinical Signs

- Drop in egg production
- Numerous deaths within 24-48 hours
- Deaths continue for 7-10 days



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Clinical signs that can be seen, particularly in chicken flocks, include an initial drop in egg production followed by numerous deaths within 24-48 hours. Deaths in the flock may continue for 7-10 days. Birds that survive for 12-14 days usually live but may have permanent neurological damage including paralysis, and reproductive damage causing decreased egg production. (Photo: USDA-APHIS from 2002-2003 California outbreak)

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Clinical Signs

- Edema of head, especially around eyes
- Greenish-dark watery diarrhea
- Respiratory and neurological signs
- Signs vary with species and virulence



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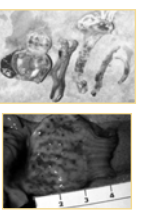
There may be edema of the head especially around the eyes, and greenish-dark watery diarrhea, as well as respiratory and neurological signs. Neurologic signs may include muscle tremors, drooping wings, dragging legs, twisting of the head and neck, circling, depression, inappetence, or complete paralysis. Clinical signs associated with the various strains can be different in species other than chickens. Vaccinated birds will have less severe signs. (Photo: USDA-APHIS from 2002-03 California outbreak)

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Post Mortem Lesions

- Indistinguishable from highly pathogenic avian influenza
- Hemorrhagic internal lesions
 - Tracheal mucosa
 - Proventriculus
 - Intestinal mucosa



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There are no specific diagnostic post mortem lesions seen with vND. Gross lesions can be very similar to highly pathogenic avian influenza, so laboratory isolation and identification is important for a definitive diagnoses. Lesions may include: edema of the interstitial tissue of the neck, especially near the thoracic inlet; congestion and sometimes hemorrhage on tracheal mucosa; petechiae and small ecchymoses on the mucosa of the proventriculus; edema, hemorrhages, necrosis or ulcerations of lymphoid tissue in the intestinal wall mucosa including Peyer's patches; and edema, hemorrhages or degeneration of the ovaries. (Photo: USDA-APHIS from 2002-03 California outbreak)

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Post Mortem Lesions

- Edema of the head and neck
- Edema, hemorrhage, necrosis or ulceration of lymphoid tissue
- Lesions vary with species and virulence



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There are no specific diagnostic post mortem lesions seen with vND. Gross lesions can be very similar to highly pathogenic avian influenza, so laboratory isolation and identification is important for a definitive diagnoses. Lesions may include: edema of the interstitial tissue of the neck, especially near the thoracic inlet; congestion and sometimes hemorrhage on tracheal mucosa; petechiae and small ecchymoses on the mucosa of the proventriculus; edema, hemorrhages, necrosis or ulcerations of lymphoid tissue in the intestinal wall mucosa including Peyer's patches; and edema, hemorrhages or degeneration of the ovaries. (Photo: USDA-APHIS from 2002-03 California outbreak)

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Differential Diagnosis

- Highly pathogenic avian influenza
- Fowl cholera
- Laryngotracheitis
- Coryza
- Fowl pox (diphtheritic form)
- Psittacosis or Pacheco's disease
- Mycoplasmosis
- Infectious bronchitis
- Management problems
 - Water or feed deprivation
 - Poor ventilation

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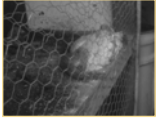
Differential diagnosis include fowl cholera, highly pathogenic avian influenza, laryngotracheitis, coryza, fowl pox (diphtheritic form), psittacosis or Pacheco's disease in psittacines, mycoplasmosis, infectious bronchitis, as well as management problems such as deprivation of water, feed or poor ventilation.

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Clinical Diagnosis

- Sudden decrease in egg production
- High morbidity and mortality
- Characteristic signs and gross lesions



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Virulent Newcastle disease may be suspected, especially in chicken flocks, with a sudden decrease in egg production, high morbidity and mortality, and characteristic signs and gross lesions; however, due to the wide variety of signs and similarities to other avian diseases, such as highly pathogenic avian influenza, definitive diagnosis requires virus isolation and identification in the laboratory. (Photo: USDA-APHIS)

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Sampling

- Before collecting or sending any samples, the proper authorities should be contacted
- Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease
- Samples may be zoonotic

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Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities should be contacted. Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease.

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Diagnosis

- Laboratory Tests
 - Virus isolation
 - Virus characterization
 - To determine virus strain and pathogenicity
 - Serology
 - No strain information, so limited value
 - May be used post-vaccinal to confirm immune response


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Lab tests for diagnosis include virus isolation via hemagglutination or hemagglutination-inhibition. Due to the presence of some strains in feral birds and the use of viruses as live vaccines, isolation of Newcastle Disease Virus is rarely sufficient to confirm a diagnosis of disease. Virus characterization by pathogenicity testing or nucleotide sequencing is necessary to determine strain and pathogenicity – necessary information for control measures. Tests available for serology include hemagglutination-inhibition and ELISA. Serology gives little information on strain so is of limited diagnostic value. Serology may be used to confirm immune response in vaccination programs. Vaccination and previous exposure to disease may affect serology results.

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Newcastle Disease in Humans



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Clinical Signs in Humans

- Eye infections
 - Reddening, excessive tearing, edema of lids, conjunctivitis, subconjunctival hemorrhage
 - Usually transient, cornea not affected
 - Lab workers and vaccination crews most susceptible
 - No human to human spread


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Eye infections, consisting of unilateral or bilateral reddening, excessive tearing, edema of the eyelids, conjunctivitis and subconjunctival hemorrhage have occurred. Infections are usually transient and the cornea is not affected. Both vaccinal and virulent poultry strains of NDV may infect and cause clinical signs in humans. Human infections have usually resulted from direct contact with the virus in laboratory settings, contamination with virus after handling infected birds or carcasses and contamination of vaccination personnel especially when vaccines are given by aerosol. These infections can usually be avoided through use of protective eyewear, protective clothing and good personal hygiene. Casual contact with infected poultry is a low risk situation for humans. There are no reports of human to human spread.

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Prevention and Control



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Recommended Actions

- Notification of Authorities
 - Federal:
 - Area Veterinarian in Charge (AVIC)
 - www.aphis.usda.gov/vs/area_offices.htm
 - State veterinarian
 - www.aphis.usda.gov/vs/sregs/official.htm
- Quarantine all suspect animals and the premises

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Due to the economically devastating nature of this disease, authorities should be notified immediately of any suspicious cases of virulent Newcastle Disease. While waiting for the authorities or a confirmed diagnosis, all suspect animals should be quarantined.

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Recommended Actions

- Confirmatory diagnosis
- Depopulation may occur
 - Proper destruction of
 - Exposed cadavers
 - Litter
 - Animal products



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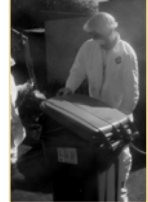
Should virulent Newcastle Disease be confirmed by diagnosis, depopulation may need to occur. Depopulation protocols include plans for the infected premises, contact exposed premises, and contiguous premises. Proper destruction of all exposed cadavers, litter and animal products are required. (Photo-USDA-APHIS from the 2002-2003 END outbreak California. It shows cleaning and disinfection crews on a backyard poultry site.)

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Control and Eradication

- Disinfection of premises
- Delay re-introduction of new birds for 30 days
- Control insects and mice
- Limit human traffic



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Additional recommendations for the control and eradication of Newcastle disease will include, disinfection of the premises, delaying reintroduction of new birds for 30 days, control of pests such as insects and mice, limit human traffic, and avoiding the introduction of new animals with unknown health status. (Photo: USDA-APHIS, euthanization of birds by compressed gas – CO2)

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Disinfection

- Virus killed by:
 - Household bleach, 6%
 - Extremes in pH
 - Less than 2 or greater than 12
 - Heat
 - Boiling one minute
 - Detergents
 - Dryness
 - Ultraviolet light and sunlight

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Effective disinfectants include the cresylics and phenolics. Novalsan-S, Roccal-D Plus, household bleach 6%. The virus can be killed by pH extremes of below 2 and above 12; heat (boiling one minute), detergents, dryness, ultraviolet light, and sunlight. The virus can survive for long periods of time in cool moist environments, frozen, in warm, humid environments, at pH between 2 and 12 and at least 3 months in liquid manure.

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Vaccination

- Vaccination routine worldwide
- Reduces clinical signs
- Does not prevent virus replication or shedding
- Not an alternative to good management, biosecurity or good hygiene in rearing practices


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Vaccination is routine in poultry flocks. While vaccination will reduce the severity of clinical disease caused by vND it will not prevent infection and virus shedding. Under no circumstances can vaccination be regarded as an alternative to good management practice, biosecurity or good hygiene in rearing domestic poultry.

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Additional Resources



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Internet Resources

- World Organization for Animal Health (OIE) website
– www.oie.int
- USAHA Foreign Animal Diseases – “The Gray Book”
– www.vet.uga.edu/vpp/gray_book/index

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Acknowledgments

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Acknowledgments

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