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**African Swine Fever**

Pesti Porcine Africaine,  
Peste Porcina Africana,  
Maladie de Montgomery

*Last Modified: November 2010*  
African Swine Fever is also known as Pesti Porcine Africaine, Fiebre Porcina Africana, and Maladie de Montgomery.

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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 African swine fever and its epidemiology. We will also talk about 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, clinical signs and necropsy findings, and diagnosis and treatment of the disease. Finally, we will address prevention and control measures for the disease and actions to take if African swine fever is suspected.

[Photo from Alex Ramirez, DVM, MPH, DACVPM, Iowa State University].


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**The Organism**

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**African Swine Fever Virus**

- Highly contagious viral disease of swine
- Asfarviridae
  - Enveloped DNA virus
  - Transmitted by arthropods
- Isolates vary in virulence
  - High virulence: up to 100% mortality
  - Low virulence: seroconversion



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African swine fever (ASF) is a highly contagious viral disease of swine. The disease is caused by the African swine fever virus (ASFV). This virus is the sole member of the new genus Asfivirus (Family: Asfarviridae) and was formerly classified as a member of the family Iridoviridae. ASFV (shown here) is a large, lipoprotein-enveloped, icosahedral, double-stranded DNA virus. The virus is the only known DNA virus that is transmitted by arthropods. The virus replicates in *Ornithodoros* ticks and can be transmitted to swine through the bite of the tick. ASFV isolates vary greatly in their virulence, with highly virulent isolates causing up to 100% mortality, and lower virulent isolates leading only to seroconversion. [Photo: virus electronmicrograph from [www.fao.org](http://www.fao.org)].

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**African Swine Fever Virus**

- Highly resistant
  - At least 30 days in pens
  - >140 days in some pork products
- Killed by high temps and some disinfectants
- Affects domestic and wild pigs



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ASFV is highly resistant in the environment and can survive for 1 to 1/2 years in blood stored at 4°C (39°F), 11 days in feces at room temperature, and at least a month in contaminated pig pens. The virus will also remain infectious for 150 days in boned meat stored at 3.9°C (39°F), 140 days in salted dried hams, and several years in frozen carcasses. ASF affects domestic pigs and wild pigs, including the warthog, bush pig, giant forest hog in Africa, and the feral pig in Europe. The collared peccary (*Tayassu tajacu*) and the white-lipped peccary (*Tayassu albirostris*) of the Americas may be able to carry the virus asymptotically.

[Photos: Top: Warthog (from mason.gmu.edu); Middle: bush pig (from <http://www.rth.org/sdzoo/Western%20bush%20pig.jpg>); Bottom: collared peccary (from <http://www.scz.org/animals/p/pic/peccary2.jpg>)] \*Link defunct as of 12/13/2010.


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Importance

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**History**

- Discovery
  - Kenya, early 1900s
- Spread to Europe
- Vector described
  - Soft ticks, 1963
- Emergence in Western Hemisphere
  - Cuba, 1971
- Recent outbreaks
  - The Caucasus (including Russia), Africa



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African swine fever, as its name implies, is endemic in Africa (particularly the southern portion). There, the virus exists in wild African swine. ASFV was discovered in the early 1900s in domesticated swine in Kenya. In 1957, the virus spread outside of Africa to Europe (specifically, Portugal). The outbreak was successfully eradicated, but soon after outbreaks of the disease occurred in additional European countries; since the 1960s outbreaks have occurred in Italy, Spain, Malta, Sardinia, Belgium, and the Netherlands. By the mid-1990s, the disease was eradicated from Europe except for feral swine on the Island of Sardinia.

In 1963, Spanish workers isolated ASFV from the soft tick *Ornithodoros erraticus* collected from ASF-infected farms. Researchers showed that the virus replicates inside the ticks and can be transferred between other species. Individual ticks can apparently remain infected for life, and infected soft tick colonies maintain the virus for years. Some researchers believe that ASFV is actually a tick virus, and that the pig is an accidental host.

In 1971, ASF first appeared in the Western Hemisphere in Cuba. The disease was eradicated following the death or depopulation of over 400,000 pigs. In the late 1970s, ASF outbreaks occurred in Brazil, the Dominican Republic, Haiti and again in Cuba. The disease has been successfully eradicated from the Western Hemisphere by depopulation measures, and ASF has never occurred in the United States. In April 2007, several outbreaks of ASF were reported in the country of Georgia (Europe); the source of the virus is unknown but thought to

have come from imported frozen or processed pig meat. Since then, ongoing outbreaks have been documented in the Caucasus and Africa.

[Photo: Sites of outbreaks of ASF in the country of Georgia in 2007. From the World Organization of Animal Health at [http://www.oie.int/wahid-prod/public.php?page=disease\\_outbreak\\_map](http://www.oie.int/wahid-prod/public.php?page=disease_outbreak_map)]

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**Economic Impact**

- Animal Health
  - High morbidity and mortality
  - Highly contagious
- Import and export bans
- Quarantine and Depopulation
  - Required for eradication
- Can become prolonged epidemic

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ASF can lead to the destruction of swine herds and severely impact swine production. ASF is an OIE reportable disease. Therefore, confirmed cases may lead to a ban on the export and import of pigs to and from many different countries with obvious economic impact. For successful eradication to occur, quarantine and depopulation of affected herds will be required to stop the further spread of the virus.

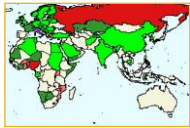
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**Epidemiology**

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**Geographic Distribution**

- Endemic
  - Southern Africa
  - Island of Sardinia (Italy)
- Recent outbreaks
  - The Caucasus
    - Georgia
    - Armenia
    - Southwest Russia



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ASF is endemic in most of sub-Saharan Africa, including the island of Madagascar. In the past, outbreaks have occurred in several European countries, including Portugal and Spain; the disease has since been eradicated from Europe, except for the island of Sardinia (Italy), where the virus is considered endemic in feral swine and a recent outbreak in the Caucasus (including Georgia, Armenia, and southwest Russia). ASF has never occurred in the United States.

[Photo: This figure shows the OIE ASF disease outbreak map from 2006 to 2010. Red indicates a current disease event, purple indicates disease limited to one or more zones, dark green indicates disease not reported in this period, and light green indicates disease never reported. From the OIE at [http://www.oie.int/wahis/public.php?selected\\_start\\_day=1&selected\\_start\\_month=1&selected\\_start\\_year=2006&selected\\_end\\_day=31&selected\\_end\\_month=12&selected\\_end\\_year=2010&page=disease\\_outbreak\\_map&date\\_submit=OK](http://www.oie.int/wahis/public.php?selected_start_day=1&selected_start_month=1&selected_start_year=2006&selected_end_day=31&selected_end_month=12&selected_end_year=2010&page=disease_outbreak_map&date_submit=OK)]

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**Morbidity/Mortality**

- Morbidity approaches 100%
  - Previously unexposed herds
- Mortality varies with virulence of isolate
  - Ranges from 0 to 100%
- May be asymptomatic in wild pigs
- No treatment or vaccine

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In domestic pigs, the morbidity (illness) rate approaches 100% in naive herds. Mortality (death) varies with the virulence of the isolate, and can range from 0 to 100%. Factors that can increase mortality from less virulent isolates include concurrent disease, young age, and pregnancy. Mild or asymptomatic disease is usually seen in warthogs and bush pigs. No treatment or vaccine currently exists for this disease.


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**Transmission**

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**Animal Transmission**

- Direct contact
  - Usually oronasal
- Indirect
  - Uncooked garbage
  - Fomites
  - Bite of infected ticks
  - Mechanically by biting flies
- Found in all tissues and body fluids



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The primary method of ASF spread from country to country has been through the feeding of uncooked garbage containing ASFV-infected pork scraps. A pig can also become infected with ASFV by direct contact with infected animals (usually by oronasal spread) or indirect contact via contaminated people, equipment, vehicles, and feed. Aerosol transmission is thought to be unimportant, and only seems to occur over short distances when pigs are in close contact. Pigs that recover may become carriers of the virus for several months. ASFV is also spread through the bite of infected *Ornithodoros erraticus* or *O. moubata* (pictured) soft ticks. Other bloodsucking insects, such as mosquitoes and biting flies, may transmit the virus mechanically. ASFV can be found in all tissues and body fluids, with particularly high levels in blood.

[Photo: *Ornithodoros* spp. (soft tick) from <http://www.nhc.ed.ac.uk/images/collections/ticks/soft/image019.jpg>]

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**Animals and African Swine Fever**

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**Clinical Signs:  
Acute Disease**

- Incubation period: <5 to 19 days
- Clinical signs
  - High fever
  - Moderate anorexia
  - Erythema, cyanosis
  - Recumbency
  - Bloody diarrhea
  - Abortion
  - Death



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The incubation period of ASF is 5 to 19 days following direct contact with infected pigs, but can be less than 5 days after exposure to infected ticks. More virulent isolates of ASFV cause a high fever, moderate anorexia, leukopenia, recumbency, and erythema that is most apparent in white pigs (top photo). Cyanotic skin blotching on the ears, tail, lower legs, or hams may also develop. Diarrhea may be mucoid or hemorrhagic (bottom photo). Abortions are frequently seen in pregnant sows. Pigs may also experience dyspnea, vomiting, and nasal and conjunctival discharges; however, most pigs infected with ASFV remain in good condition. With highly virulent isolates, progressive anorexia and depression develop and are usually followed by death within 10 days. Peracute disease is characterized by sudden death with few lesions, and may be the first sign of an infection in a herd.

[Photo: Clinical signs seen with African Swine Fever from [www.defra.gov.uk](http://www.defra.gov.uk)]

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**Clinical Signs:  
Chronic Disease**

- Multi-focal erythema
  - Ears, abdomen
  - Raised or necrotic areas
- Intermittent, low fever
- Coughing
- Painless joint swelling
- Emaciation, stunting
- Death



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Multi-focal erythema on the ears, abdomen, and inner thighs is a common clinical sign of chronic infection. The foci may become raised and necrotic, as shown above. A low fever may also be present. Other possible signs of ASF include pneumonia and painless swelling of the carpal and/or tarsal joints. Additionally, pigs may be emaciated or stunted. Death may result from chronic ASF.

[Photos: (top and bottom): Erythema of the ears from [www.vet.uga.edu/vpp/gray\\_book02/index.php](http://www.vet.uga.edu/vpp/gray_book02/index.php)]

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**Post Mortem Lesions:  
Most Common**

- Hemorrhagic
  - Spleen
    - Enlarged
    - Friable
    - Dark red, black
  - Lymph nodes
  - Kidneys
  - Heart



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The gross lesions of African swine fever are highly variable. The most consistent and characteristic post mortem lesions occur in the spleen and lymph nodes. With highly virulent infections, the spleen is usually enlarged, friable, and dark red or black (top photo). With moderately virulent infections, the spleen is enlarged but not friable, with a nearly normal color. Lymph nodes may be swollen and hemorrhagic, with the most commonly affected lymph nodes being the gastrohepatic (bottom photo), renal, and mesenteric. The tonsils may also be swollen or reddened.

[Photo Source: [www.vet.uga.edu/vpp/gray\\_book02/index.php](http://www.vet.uga.edu/vpp/gray_book02/index.php)]

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**Post Mortem Lesions:  
Chronic Infection**

- Focal skin necrosis
- Fibrinous pericarditis
- Generalized lymphadenopathy
- Swollen joints
- Consolidated lobules in lung



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In animals with chronic African swine fever, the carcass may be emaciated. The most common post mortem lesions are focal skin necrosis (top photo), fibrinous pericarditis, generalized lymphadenopathy, swollen joints, and consolidated lobules in the lung (bottom photo).

[Photo source: [www.vet.uga.edu/vpp/gray\\_book02/index.php](http://www.vet.uga.edu/vpp/gray_book02/index.php)]

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**Post Mortem Lesions:  
Less Common**

- Hemorrhages in additional organs
  - Petechiae
  - Ecchymoses
- Edema
  - Lungs and gall bladder



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Less consistent post mortem signs of ASFV infection include hemorrhages, including petechiae and ecchymoses, in order organs such as the urinary bladder, lungs, heart, stomach, and intestines. Edema may be found in the lungs and gall bladder (bottom and top photos); and the pleural, pericardial, and peritoneal cavities may contain excess fluid. Dark red or purple areas may also be found on the skin of ears, feet, and tail.

[Photo source: [www.vet.uga.edu/vpp/gray\\_book02/index.php](http://www.vet.uga.edu/vpp/gray_book02/index.php)]

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**Differential Diagnosis**

- Classical swine fever (hog cholera)
- Acute PRRS
- Porcine dermatitis and nephropathy syndrome
- Erysipelas
- Salmonellosis
- Eperythrozoonosis
- Actinobacillosis
- Glasser's disease
- Aujeszky's disease (pseudorabies)
- Thrombocytopenic purpura
- Warfarin poisoning
- Heavy metal toxicity

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The differential diagnoses for ASF include hog cholera (more commonly known as classical swine fever, which is clinically indistinguishable from ASF), acute porcine reproductive and respiratory syndrome (PRRS), erysipelas, salmonellosis, eperythrozoonosis, actinobacillosis, Glasser's disease (*Haemophilus parasuis* infection), Aujeszky's disease (pseudorabies), thrombocytopenic purpura, warfarin poisoning, heavy metal toxicity, and other generalized septicemic or hemorrhagic conditions.

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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

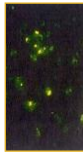
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Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities (state and/or federal veterinarian) should be contacted. Samples should only be sent under secure conditions and to authorized laboratories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

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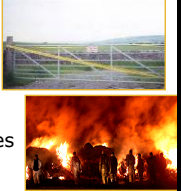
**Diagnosis**

- Suspect ASF in pigs with:
  - Fever
  - Characteristic post mortem signs in spleen, lymph nodes
- Laboratory tests
  - Virus isolation
  - Viral antibody detection
  - PCR



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ASF should be suspected in pigs with a fever and when necropsy findings include an enlarged, friable, dark red or black spleen and extremely enlarged and hemorrhagic lymph nodes. In areas where ASF is not endemic, the disease should be diagnosed by virus isolation, detection of viral antibodies by the fluorescent antibody test (shown above), and PCR. For virus isolation, blood and tissue samples (such as spleen, lymph nodes, lung) from suspect pigs are inoculated into pig leukocyte or bone marrow cultures. For the fluorescent antibody test, ASFV antigens are detected in tissue smears or cryostat sections. Nucleic acids can be detected by the PCR assay (which is particularly useful in putrefied samples that can't be used for virus isolation). A rapid, real time PCR technique using tonsil scraping samples has been described; this test can detect the virus a few days before the onset of symptoms. [Photo source: [www.fao.org](http://www.fao.org)]

<p>S l i d e  2 3</p>	<p style="text-align: center;"><b>Treatment</b></p> <ul style="list-style-type: none"> <li>• No treatment should be attempted</li> <li>• Actions needed will be directed by state and/or federal animal health authorities</li> <li>• Slaughter             <ul style="list-style-type: none"> <li>- Confirmed cases</li> <li>- In-contact animals</li> <li>- Possibly complete herd slaughter</li> </ul> </li> <li>• Area restrictions on pig movements</li> </ul> <p style="text-align: right; font-size: small;">Center for Food Security and Public Health, Iowa State University, 2011</p>	<p>No treatment should be attempted for pigs suspected with ASF. The state veterinarian or Federal Area Veterinarian in Charge (AVIC) should be contacted immediately upon suspicion of disease. Actions needed will be directed by these animal health authorities. Confirmed cases and in-contact animals should be slaughtered, and measures taken to protect other pigs in the area. This may entail complete herd slaughter combined with area restrictions on pig movements, or vaccination (depending on local disease control regulations). <b><u>Note: Producers will only receive indemnity for animals destroyed under the order of animal health officials.</u></b></p>
<p>S l i d e  2 4</p>	<p style="text-align: center;"><b>African Swine Fever in Humans</b></p> <p style="text-align: center;">Humans are not susceptible</p>	<p>ASF is not a zoonotic disease, and no human cases have been reported.</p>
<p>S l i d e  2 5</p>	<p style="text-align: center;"><b>Prevention and Control</b></p>	
<p>S l i d e  2 6</p>	<p style="text-align: center;"><b>Recommended Actions</b></p> <ul style="list-style-type: none"> <li>• IMMEDIATELY notify authorities</li> <li>• Federal             <ul style="list-style-type: none"> <li>- Area Veterinarian in Charge (AVIC)</li> <li><a href="http://www.aphis.usda.gov/animal_health/area_offices/">http://www.aphis.usda.gov/animal_health/area_offices/</a></li> </ul> </li> <li>• State             <ul style="list-style-type: none"> <li>- State veterinarian</li> <li><a href="http://www.usaha.org/StateAnimalHealthOfficials.pdf">http://www.usaha.org/StateAnimalHealthOfficials.pdf</a></li> </ul> </li> <li>• Quarantine</li> </ul>	<p>If you suspect a case of African swine fever, state or federal authorities should be notified immediately. Animals suspected with ASF should be isolated, and the farm should be quarantined until definitive diagnosis is determined.</p>
<p>S l i d e  2 7</p>	<p style="text-align: center;"><b>Quarantine</b></p> <ul style="list-style-type: none"> <li>• Suspicion of ASF             <ul style="list-style-type: none"> <li>- Quarantine                 <ul style="list-style-type: none"> <li>• Entire herd</li> <li>• Strict enforcement</li> <li>• Authorities notified</li> <li>• Diagnosis confirmed</li> </ul> </li> </ul> </li> <li>• Disposal of carcasses             <ul style="list-style-type: none"> <li>- Burial</li> <li>- Burning</li> </ul> </li> </ul>  <p style="text-align: right; font-size: small;">Center for Food Security and Public Health, Iowa State University, 2011</p>	<p>Strict quarantine must be imposed if ASF is suspected. The entire herd must be quarantined immediately until authorities are notified and a diagnosis is confirmed (top photo courtesy of Katie Steneroden, ISU). Successful eradication is accomplished by rapid diagnosis, slaughter, and disposal of all animals on the infected premises. Disposal of carcasses, often by burning, is necessary (bottom photo). Burial is another disposal option.</p>

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### Disinfection

- Many disinfectants ineffective
- Use an EPA-approved disinfectant
- Additional products available for use by USDA-APHIS only

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Since many common disinfectants are ineffective, care should be taken to use a disinfectant specifically approved for ASFV by the Environmental Protection Agency (EPA). Additional disinfectants are approved for use against ASFV (under FIFRA Section 18) for use by USDA-APHIS only. Disinfection of equipment, vehicles, and people (shown above) is essential when there has been exposure to an area with suspicion or confirmed diagnosis of ASF.

[Photos courtesy of [www.fao.org](http://www.fao.org)]

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### Prevention

- Garbage fed to pigs must be cooked
  - Unprocessed meat must be heated
- Potential tick vectors
  - Controlled with acaricides
- Isolation of infected animals
- Eradication
  - Slaughter of infected and in-contact animals


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To prevent ASF, all garbage fed to pigs should be cooked to prevent introduction of ASFV into areas free of the disease. Unprocessed meat must be heated to at least 70°C (158°F) for 30 minutes to inactivate the virus; however, 30 minutes at 60°C (140°F) is sufficient for serum and bodily fluids. Potential tick vectors should be controlled with acaricides. Because ASFV is so contagious, eradication is by slaughter of infected and in-contact animals.

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### Vaccination

- No effective vaccine
- We all need to do our part
  - Keep our pigs healthy
  - Free of foreign animal diseases



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There is no vaccine against ASFV; all attempts thus far to develop one have been unsuccessful. We all need to do our part to keep our pigs healthy and free of foreign animal diseases such as African swine fever by following the guidelines already mentioned.

[Photo courtesy of Alex Ramirez, DVM, MPH, DACVPM, Iowa State University]

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### Additional Resources

- World Organization for Animal Health (OIE)
  - [www.oie.int](http://www.oie.int)
- U.S. Department of Agriculture (USDA)
  - [www.aphis.usda.gov](http://www.aphis.usda.gov)
- Center for Food Security and Public Health
  - [www.cfsph.iastate.edu](http://www.cfsph.iastate.edu)
- USAHA Foreign Animal Diseases ("The Gray Book")
  - [www.usaha.org/pubs/fad.pdf](http://www.usaha.org/pubs/fad.pdf)

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### Acknowledgments

*Development of this presentation was funded by grants from the Centers for Disease Control and Prevention, the Iowa Homeland Security and Emergency Management Division, and the Iowa Department of Agriculture and Land Stewardship to the Center for Food Security and Public Health at Iowa State University.*

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