

Vulnerability of U.S. Animal Agriculture and Food Production to Accidental or Intentional Disease Introduction

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Animals are Susceptible to All the CDC Listed Bioterrorism Agents (Except Smallpox)

Disease From Potential Bioterrorist Agents



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CDC Category	Human	Person-to-Person Vector Transmitted Zoonotic	Route of Transmission	=Potential System Affected					Incubation Period (days)	Prominent Clinical Signs
				Septicemia	Respiratory	Intestinal	Cutaneous	Ocular		
A	Anthrax <i>Bacillus anthracis</i>	infected animal; inhalation; contaminated food	•••••	•••••	•••••	•••••	•••••	•••••	1-7	Flu-like signs; pustules; scabs; respiratory distress; wide mediastinum on x-ray; bloody vomit and diarrhea; abdominal distress; sepsis; shock; death
A	Botulism <i>Clostridium botulinum</i> toxin	contaminated food; inhalation	•••••	•••••	•••••	•••••	•••••	•••••	1-5	Weakness; dizziness; dry mouth; nausea; vomiting; cranial nerve deficits; double vision; drooping eyes; slurred speech; symmetrical paralysis; respiratory paralysis; death
A	Plague <i>Yersinia pestis</i>	fleas; infected animal; inhalation	•••••	•••••	•••••	•••••	•••••	•••••	1-6	Flu-like signs; enlarged tender lymph nodes "buboes"; rapid pneumonia; respiratory failure; toxemia; shock; death
A	Smallpox <i>Variola major</i>	direct contact with infected human; inhalation	•••••	•••••	•••••	•••••	•••••	•••••	7-17	Flu-like signs; vomiting; rash to pustules (skin, throat, mouth); death
A	Tularemia <i>Francisella tularensis</i>	arthropods; tick, deer fly, mosquito; inhalation; infected animal tissue; contaminated food, water	•••••	•••••	•••••	•••••	•••••	•••••	1-14	Flu-like signs; exhaustion; ulcerative lesions; enlarged painful lymph nodes; painful purulent conjunctivitis; abdominal pain; diarrhea; vomiting; chest pain; respiratory distress; pneumonia; sepsis; death
A	Viral Hemorrhagic Fevers <i>Ebola, Marburg, Lassa, Machupo</i>	varies with virus: direct contact with infected humans or animal reservoirs	•••••	•••••	•••••	•••••	•••••	•••••	2-21	Flu-like signs; fever; headache; vomiting; diarrhea; petechiae; maculopapular to hemorrhagic rash; hepatic damage; renal failure; seizures; shock; coma; death
B	Brucellosis <i>Brucella species</i>	contact with infected animal tissue; inhalation; contaminated food	•••••	•••••	•••••	•••••	•••••	•••••	1-21	Flu-like signs; cyclic fever; arthritis; orchitis; epididymitis; hepatomegaly; Chronic: neurological; endocarditis
B	Glanders <i>Burkholderia mallei</i>	infected animal; inhalation; wound contamination	•••••	•••••	•••••	•••••	•••••	•••••	1-14	Flu-like signs; diarrhea; chest pain; pulmonary signs; pustules; ulcerations; swollen lymph nodes; photophobia
B	Melioidosis <i>Burkholderia pseudomallei</i>	inhalation; infected body fluids; wound contamination	•••••	•••••	•••••	•••••	•••••	•••••	2 days to years	Flu-like signs; pustules; chronic abscesses; chest pain; pneumonia; bronchitis; acute sepsis; death
B	Psittacosis <i>Chlamydia psittaci</i>	inhalation of dust from infected bird dander, droppings or secretions	•••••	•••••	•••••	•••••	•••••	•••••	7-28	Flu-like signs; rash; extensive pneumonia; endocarditis; myocarditis; encephalitis
B	Q Fever <i>Coxiella burnetii</i>	tick; inhalation; infected animal body fluids (urine, milk, blood, birthing)	•••••	•••••	•••••	•••••	•••••	•••••	10-40	Flu-like signs; severe sweats; weakness; retrobulbar headache; pneumonia but no cough or chest pain; granulomatous hepatitis; osteomyelitis; arteritis; endocarditis; neurologic signs; thrombocytopenia;



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CDC Category	Animal	Severity of disease in potentially affected species										Incubation Period	Prominent Clinical Signs
		Cattle	Sheep	Goats	Pigs	Horses	Dogs	Cats	Birds	Other			
A	Anthrax <i>Bacillus anthracis</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	3-7 days	Sudden death from septicemia with lack of rigor mortis; blood fails to clot; excitement followed by depression or stupor; blood from mouth, nose, anus; edema, especially neck, throat and shoulders
A	Botulism <i>Clostridium botulinum</i> toxin	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	24-72 hours	Muscle paralysis - progressive symmetrical to flaccid; disturbed vision; unable to swallow or chew; death from respiratory or cardiac paralysis
A	Plague <i>Yersinia pestis</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	Variable; several days	High fever; extremely swollen lymph nodes—"buboes"; severe pneumonia; septicemia
A	Tularemia <i>Francisella tularensis</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	1-10 days	Sudden high fever with lethargy and anorexia; stiffness; reduced mobility; tachycardia; tachypnea; prostration and death; milary white necrotic foci of liver, spleen or lymph node
A	Viral Hemorrhagic Fevers <i>Ebola, Marburg, Lassa, Machupo</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	2-16 days	Fever; petechiae; bleeding from orifices and internal organs; skin rash; splenomegaly
B	Brucellosis <i>Brucella melitensis</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	Variable	Abortions; stillborn or weak newborns; retained placentas; placentitis; orchitis; epididymitis; arthritis; lameness; Goats: may also have mastitis
B	Brucellosis <i>Brucella abortus, B. ovis, B. suis, B. canis</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	Variable	Abortions; stillborn or weak newborns; placentitis; orchitis; epididymitis; arthritis; lameness; Horses: suppurative bursitis ("fistulous withers")
B	Glanders <i>Burkholderia mallei</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	2 weeks	Ulcerated nodules on skin, upper respiratory tract, lungs; septicemia; high fever; thick mucopurulent nasal discharge; respiratory signs
B	Melioidosis <i>Burkholderia pseudomallei</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	Variable; latency	Signs vary with site of lesion; suppurative or caseous lesions in lymph nodes, lungs, and viscera; pneumonia; possibly nasal discharge, arthritis or lameness; Horses: neurological; colic; Goats: mastitis
B	Psittacosis <i>Chlamydia psittaci</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	3-10 days	Nasal and ocular discharges; conjunctivitis; yellow-green droppings; inactivity; ruffled feathers; inappetence; weight loss
B	Q Fever <i>Coxiella burnetii</i>	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	1-3 weeks	Typically asymptomatic. Sheep, Goats: abortion; anorexia; Cattle: infertility; sporadic abortion; Dog, Cat: subclinical; abortions



Bioterrorism Agents that Must be Controlled in Animals to Protect People

- Plague
- Tularemia
- Brucellosis
- Glanders
- Melioidosis
- Psittacosis
- Q Fever
- Nipah virus



USDA High-Consequence Foreign Animal Diseases and Pests (Agroterrorism potential)

Tier 1: Diseases are those of national concern

- African swine fever*
- classical swine fever*
- foot-and-mouth disease*
- **avian influenza** (any strain that is highly pathogenic or has zoonotic significance)*
- virulent Newcastle disease*

Tier 2: diseases transmitted primarily by pests

- heartwater
- **New World screwworm**
- **Rift Valley fever***
- **Venezuelan equine encephalitis***

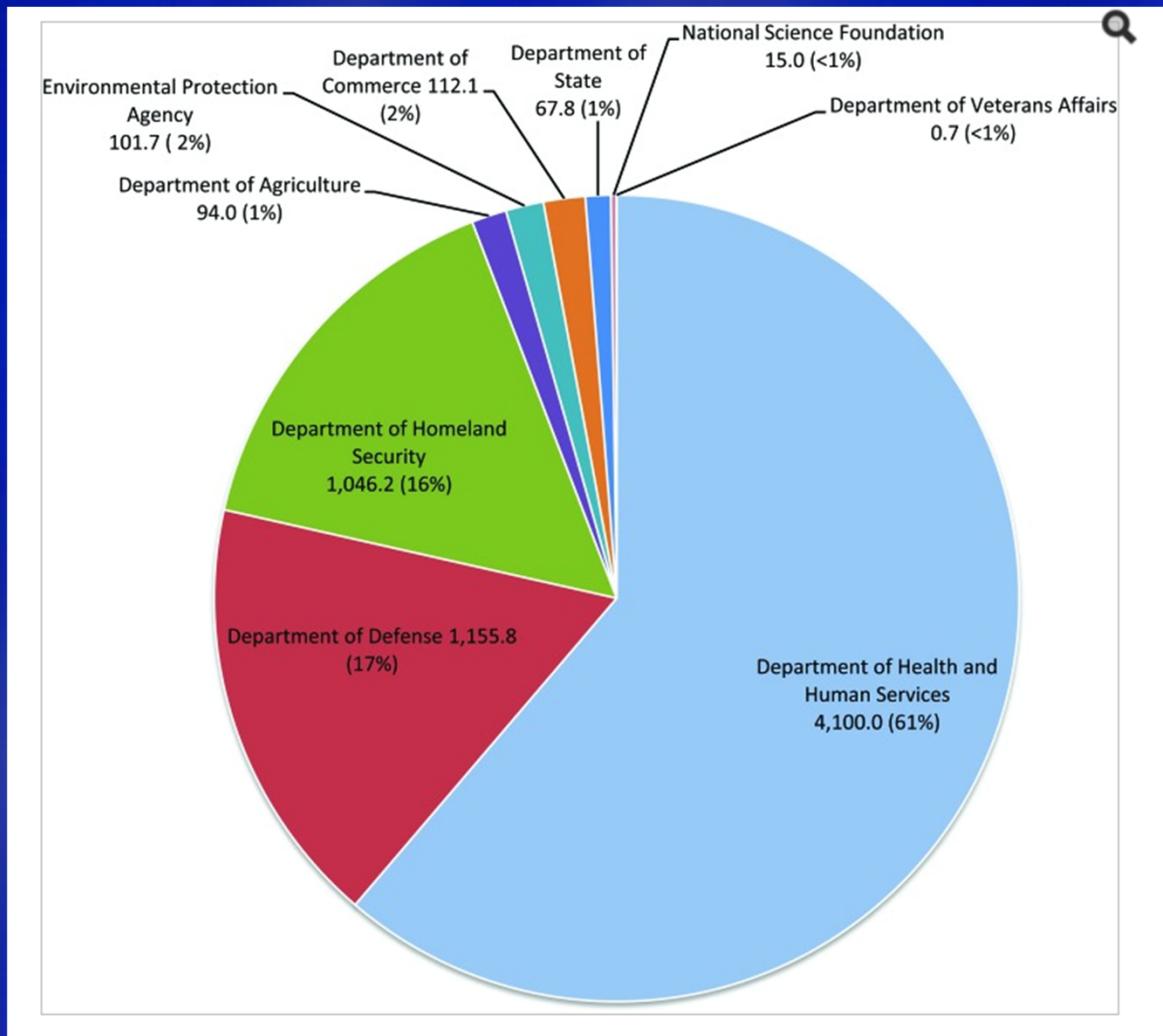
Tier 3: potential negative impact on animal or human health

- African horse sickness
- contagious bovine pleuropneumonia and contagious caprine pleuropneumonia
- **glanders and melioidiosis**
- **henipaviruses (Hendra and Nipah)***
- rinderpest* and peste des petits ruminants*
- tropical bont tick

Yellow = Significant Zoonoses

* Identified by APHIS as biological threats and program priorities for countermeasures

Civilian Biodefense Budget by Agency, FY2014



The food and agriculture sector is designated by DHS as Critical Infrastructure

- Accounts for roughly 1/5 of the nation's economic activity
- Accounts for a major percentage of the positive contribution to the trade balance for the U.S.

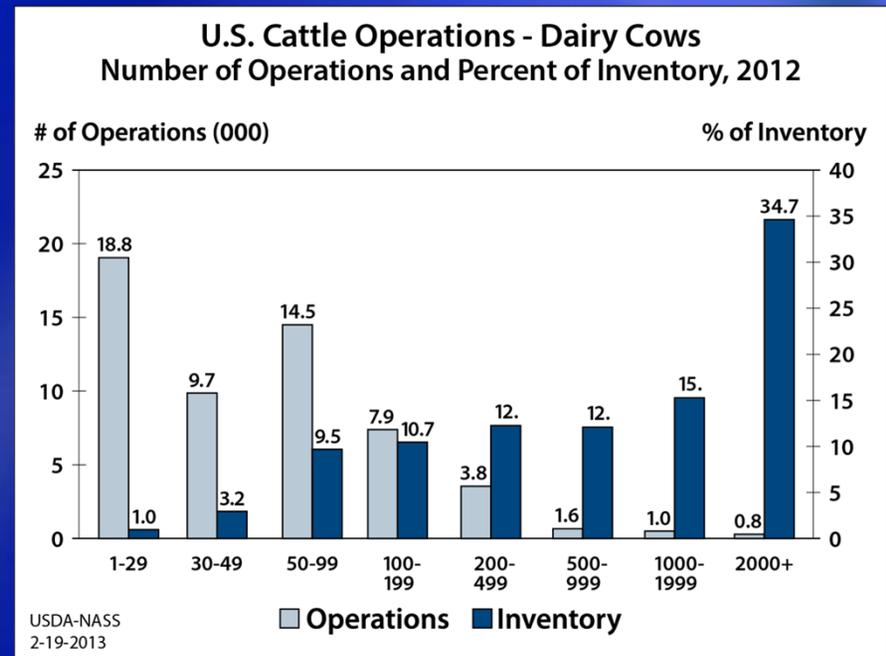
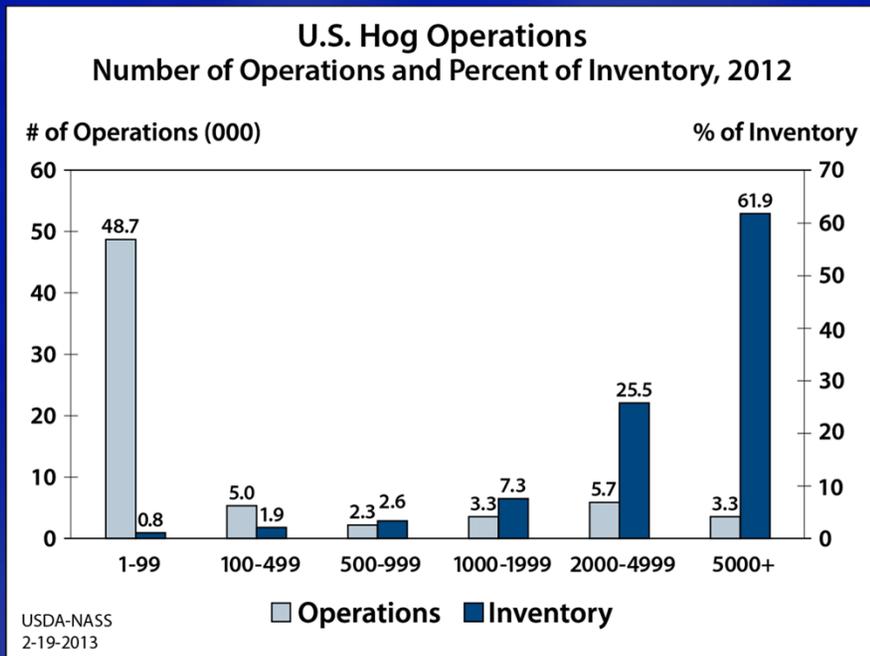
U.S. Animal Agriculture Industry is Unique

Very large Herd/Flock size:

- Laying hens: >6 million
- Dairy cows: >10,000
- Dairy calves >70,000
- Feedlot cattle: >90,000
- Swine: >20,000



U.S. Animal Agriculture is Diverse



The USDA has to be prepared to manage animal disease outbreaks on all sizes and types of operations

Highly Pathogenic H5N2 Avian Influenza in Iowa, 2015

Estimated \$1.2 billion impact on Iowa economy
Nearly \$1.0 billion cost to federal government

April 13 to June 16, 2015

77 infected sites

- 6 "Backyard" sites
- 71 Commercial sites

Major problems with carcass disposal

H5N2 was not zoonotic

Total Poultry Affected	31,502,052
Layers	24,725,086
Pullets	5,624,336
Turkeys	1,128,729
Hatchery	18,791
Backyard Flocks	5,110

<http://www.iowaagriculture.gov/AvianInfluenza.asp>



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Foot and Mouth Disease (FMD)

The most contagious disease of livestock

FMD is the major animal disease preventing world trade of animals and animal products

Nine outbreaks in U.S. between 1870 and 1929

Endemic in 96 countries

Not a public health or food safety concern

An outbreak of FMD in the U.S. would be economically devastating



UK '01



Korea '10

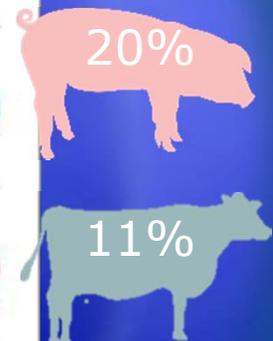
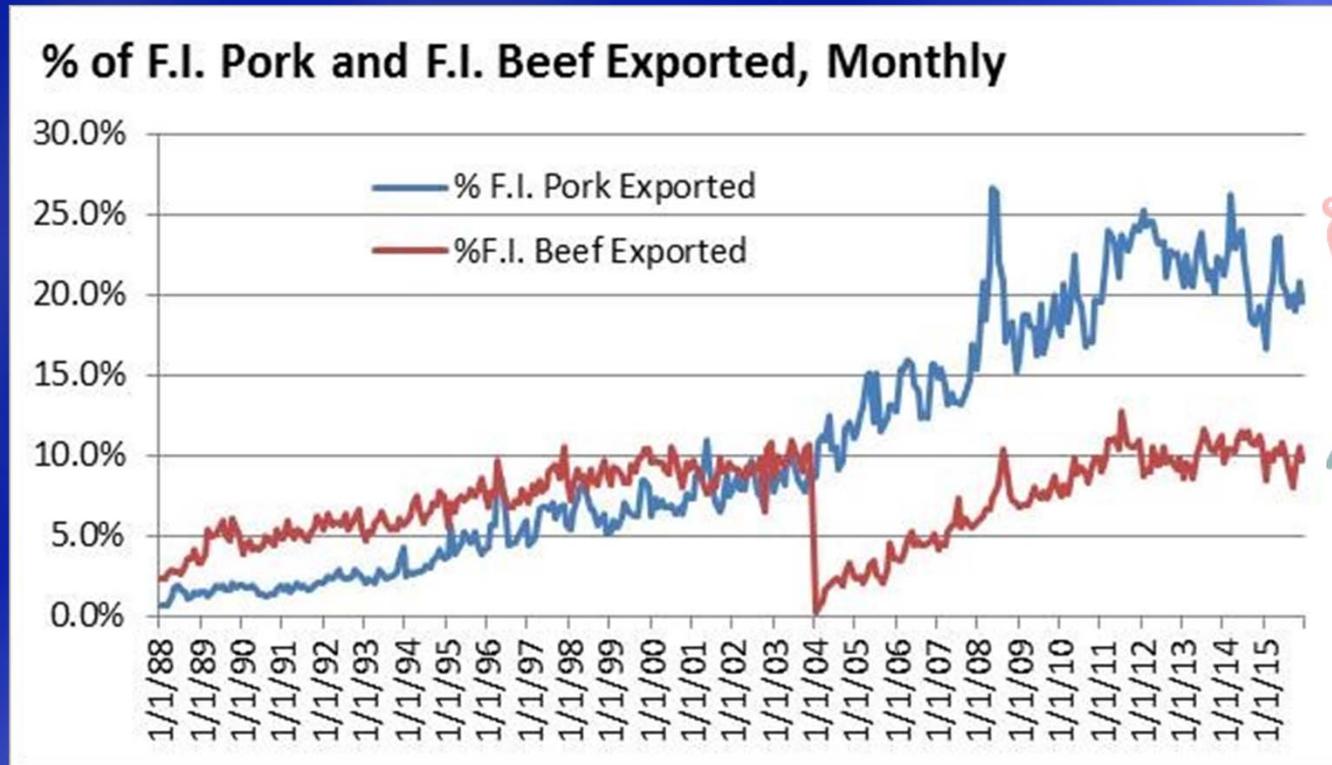


Japan '10



Egypt '12

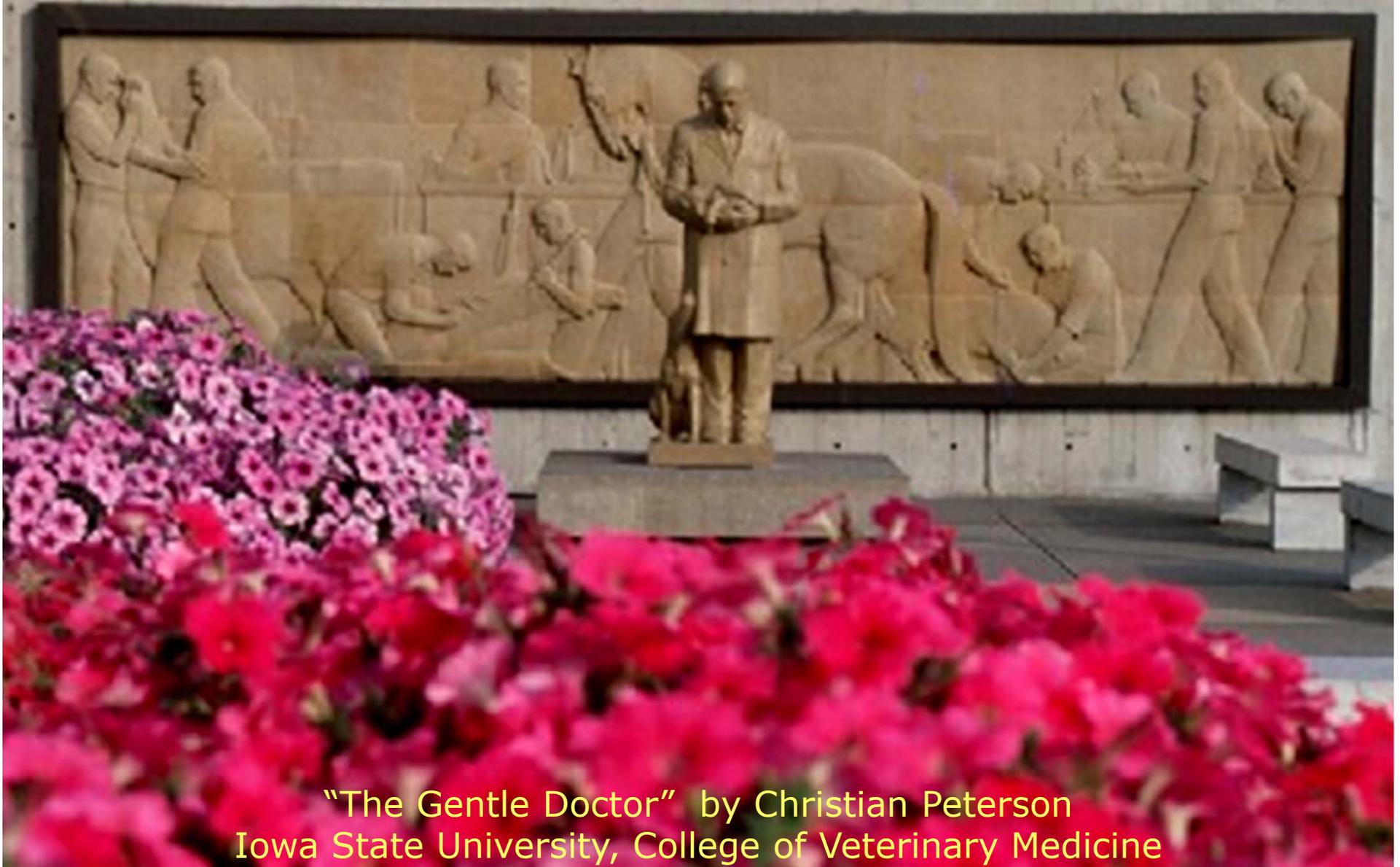
Percent of Federally-Inspected (F.I.) Beef and Pork Exported from the U.S. 1988-2015



Beef, pork, and dairy exports = ~ \$19 billion/year
Cost of treatment, control and eradication = ??
Commodity prices would drop dramatically

Source: <http://www.qtagonline.com/ginzel-weekly-hog-pork-report-4-8-2016/>

Questions or Comments?



"The Gentle Doctor" by Christian Peterson
Iowa State University, College of Veterinary Medicine