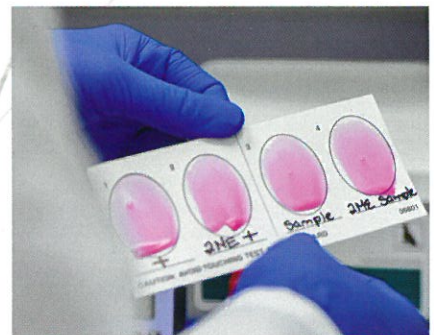
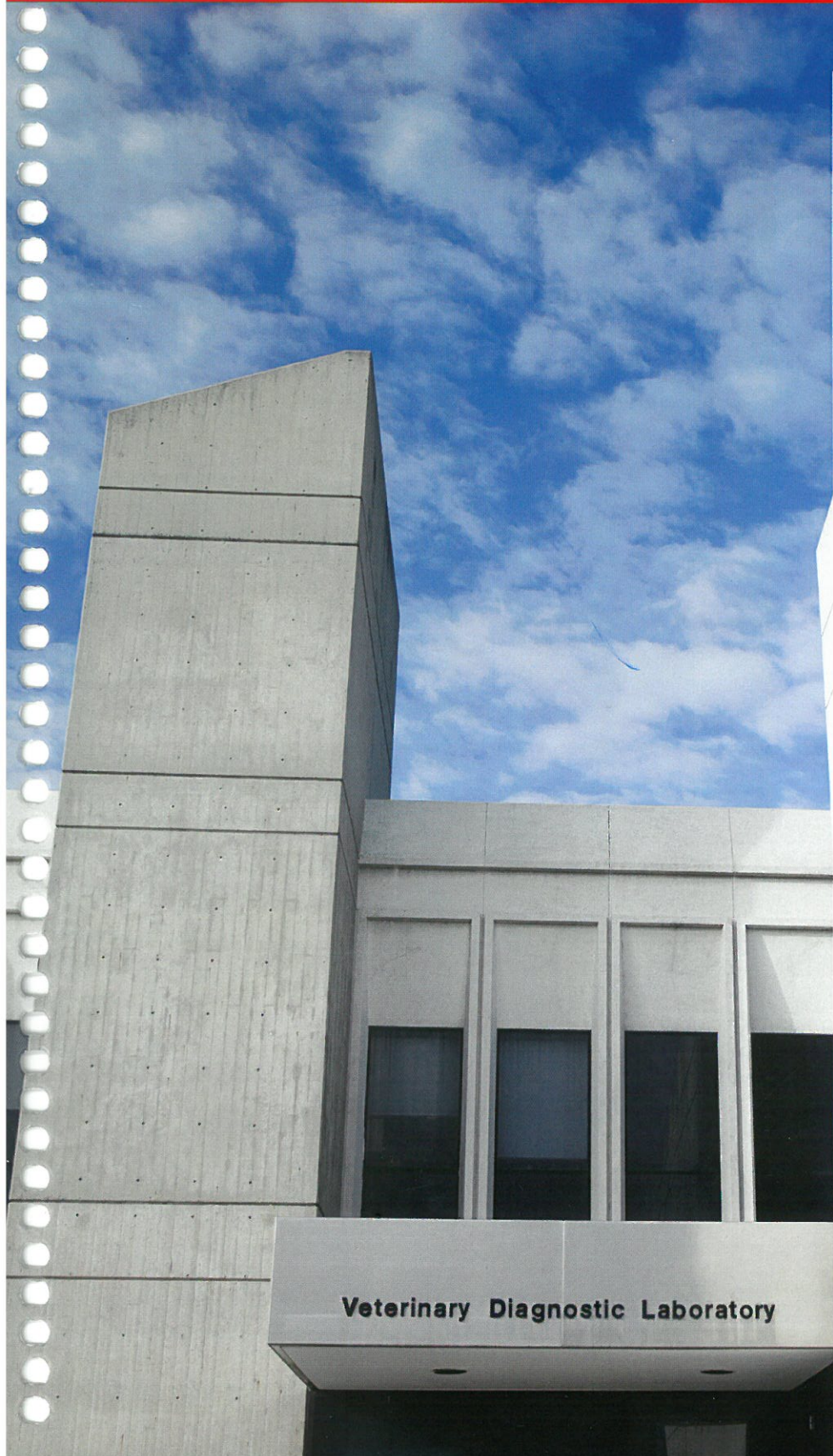


# IOWA STATE UNIVERSITY

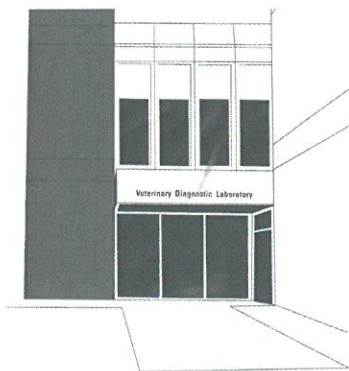
## Veterinary Diagnostic Laboratory



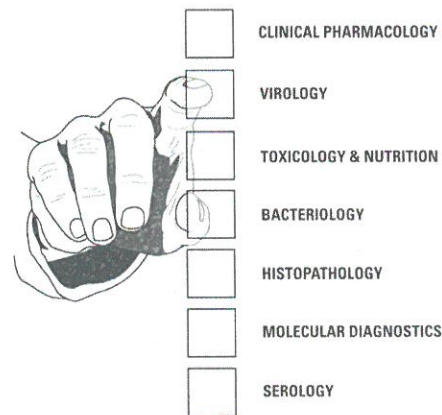
1850 Christensen Drive  
Ames, IA 50011-1134



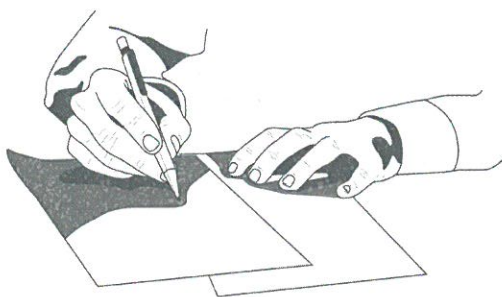
## 1. ISU VDL RECEIVES CASES FROM PRACTICING VETERINARIANS



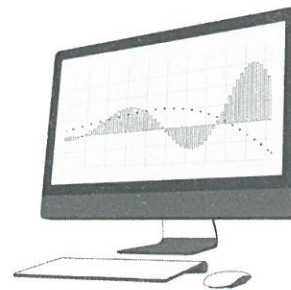
## 2. ISU VDL DIAGNOSTICIAN SELECTS TESTS BASED ON HISTORY



## 3. RESULTS COORDINATED TO ARRIVE AT DIAGNOSIS

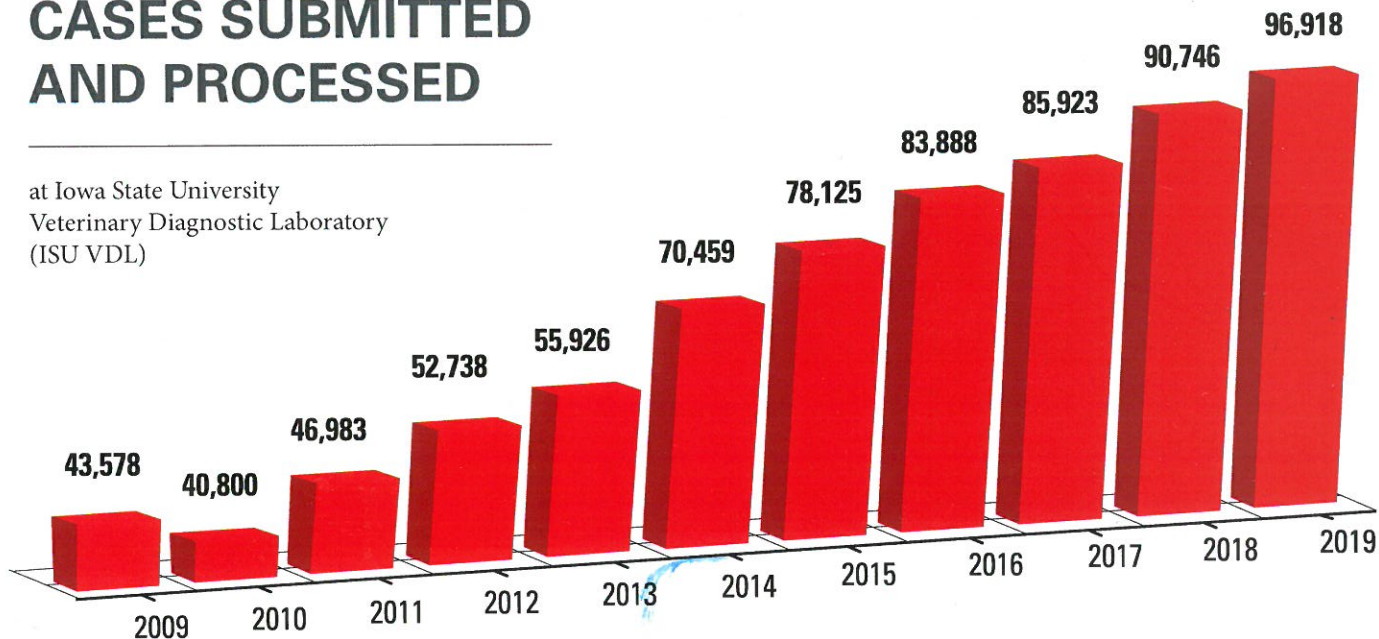


## 4. RESULTS AND DIAGNOSIS TRANSMITTED TO ASSIST PRACTICING VETERINARIANS AND ANIMAL OWNERS



## CASES SUBMITTED AND PROCESSED

at Iowa State University  
Veterinary Diagnostic Laboratory  
(ISU VDL)



L.L. Schulz et al.

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## Economic impact of university veterinary diagnostic laboratories: A case study

Lec L. Schulz<sup>a,\*</sup>, Dermot J. Hayes<sup>b</sup>, Derald J. Holtkamp<sup>b</sup>, David A. Swenson<sup>b</sup>

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### ARTICLE INFO

**Keywords:**  
Animal disease  
Economic contribution  
Economic impact  
Returns on investment  
Veterinary diagnostic laboratories

### ABSTRACT

Veterinary diagnostic laboratories (VDLs) play a significant role in the prevention and mitigation of endemic and emerging animal diseases. They also allow for business continuity in livestock operations and help improve human health. Despite these critical societal roles, there is no academic literature on the economic impact of VDLs. We present a case study on the economic impact of the Iowa State University Veterinary Diagnostic Laboratory (ISUVDL). We use economic contribution analysis coupled with a stakeholder survey to estimate the impact. Results suggest that the ISUVDL is responsible for \$2,162.46 million in direct output, \$2,832.45 million in total output, \$1,158.19 million in total value added, and \$31.79 million in state taxes in normal years. In an animal health emergency this increases to \$8,446.21 million in direct output, \$11,063.00 million in total output, \$4,523.70 million in total value added, and \$124.15 million in state taxes. The ISUVDL receives \$4 million annually as a direct state government appropriation for operating purposes. The \$31.79 million in state taxes in normal years and the \$124.15 million in state taxes in an animal health emergency equates to a 795% and 3104% return on investment, respectively. Estimates of the economic impact of the ISUVDL provide information to scientists, administrators, and policymakers regarding the efficacy and return on investment of VDLs.

### 1. Introduction

Much of the work done by veterinary diagnostic laboratories (VDLs) is routine and contributes to animal agriculture by allowing for the movement of animals, diagnosis of disease, prevention and treatment of disease, and ongoing monitoring of the health status of animals. The work of VDLs becomes much more crucial when trade-limiting diseases occur. Under these circumstances, it might be impossible to send samples to other states for testing, and the presence of a VDL that rapidly identifies, helps control, and treats a disease is critical to the financial performance of the animal agriculture industry. Funding to support VDL operations is typically derived from clinical diagnostic service fees and contracts and government appropriations. Whether these appropriations, or tax dollars, provide a sufficient return on investment depends on the contribution of VDLs to the productivity, growth, and ultimately size of an animal agriculture industry, which subsequently generates taxes that offset spending. The aim of this study is to provide a simple and transparent method to estimate the economic impact of VDLs, something currently absent in the literature. The Iowa State University Veterinary Diagnostic Laboratory (ISUVDL) is used as a

case study. The ISUVDL was selected as a case study because it is located in one of the most intensively populated animal agriculture regions in the nation. As a result, the Iowa economy is highly dependent on the animal agriculture industry, which amplifies the importance of the economic impact of disease outbreaks.

### 2. The role and activities of the ISUVDL

Animal agriculture includes raising of livestock to provide meat, milk, fiber, and other products to consumers. Iowa is a major producer and net exporter of beef, pork, poultry, dairy, and egg products. Iowa hog and pig production totaled 12,511 million pounds (5,674,732 metric tons) in 2015 (USDA-NASS, 2016a). Iowa cattle and calf production totaled 1904 million pounds (863,708 metric tons) in 2015 (USDA-NASS, 2016a). In 2015, Iowa raised 9.1 million turkeys or 354 million pounds (160,567 metric tons) of turkey production (USDA-NASS, 2016b). Iowa sold for slaughter 11.3 million chickens, or 37 million pounds (16,904 metric tons) of chicken production, in 2015 (USDA-NASS, 2016b). Iowa egg production totaled 12,463 million eggs in 2015 (USDA-NASS, 2016b). Iowa produced 4841 million pounds

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\* Corresponding author at: 478D Hedy Hall, 518 Farm House Lane, Ames, IA, 50011, United States.  
E-mail address: [lschulz@iastate.edu](mailto:lschulz@iastate.edu) (L.L. Schulz).

<https://doi.org/10.1016/j.pvetmed.2017.12.015>  
Received 2 September 2017; Received in revised form 21 December 2017; Accepted 31 December 2017  
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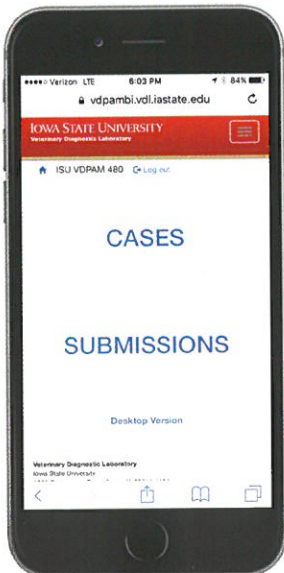
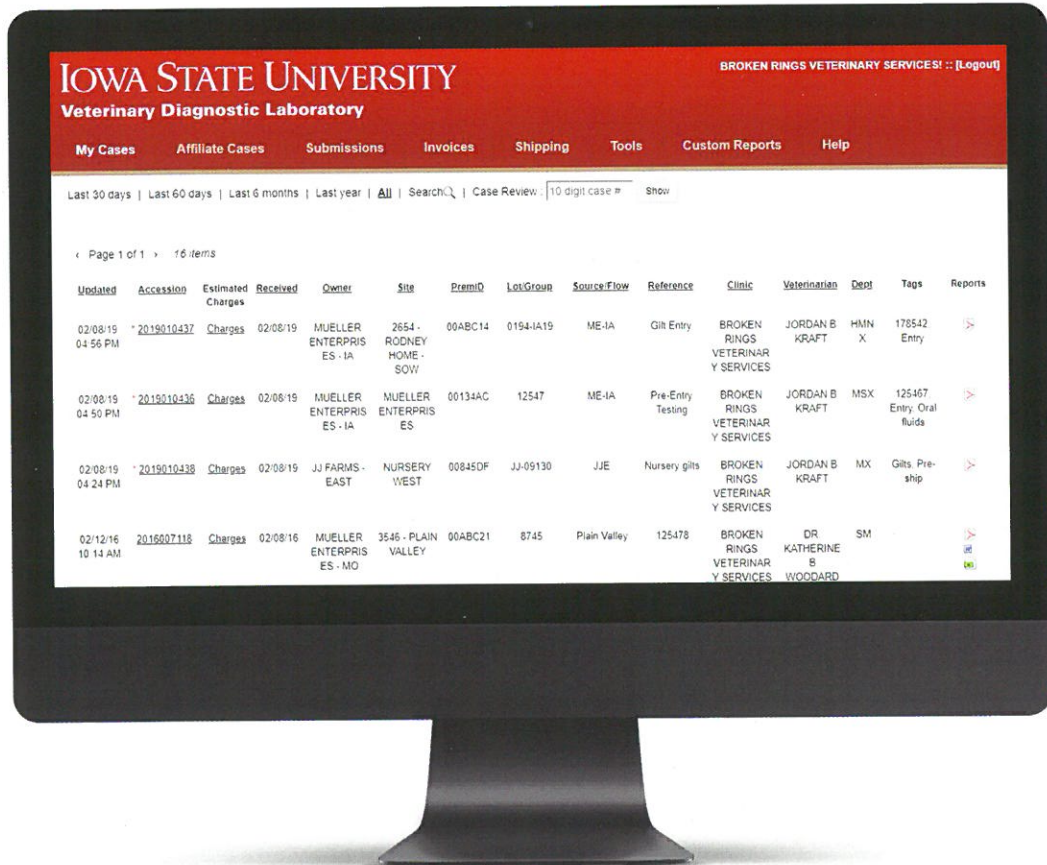
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The ISUVDL receives \$4 million annually as a direct state government appropriation for operating purposes. The \$31.79 million in state taxes in normal years and the \$124.15 million in state taxes in an animal health emergency equates to a 795% and 3104% return on investment, respectively. Estimates of the economic impact of the ISUVDL provides information to scientists, administrators, and policymakers regarding the efficacy and return on investment of VDLs.

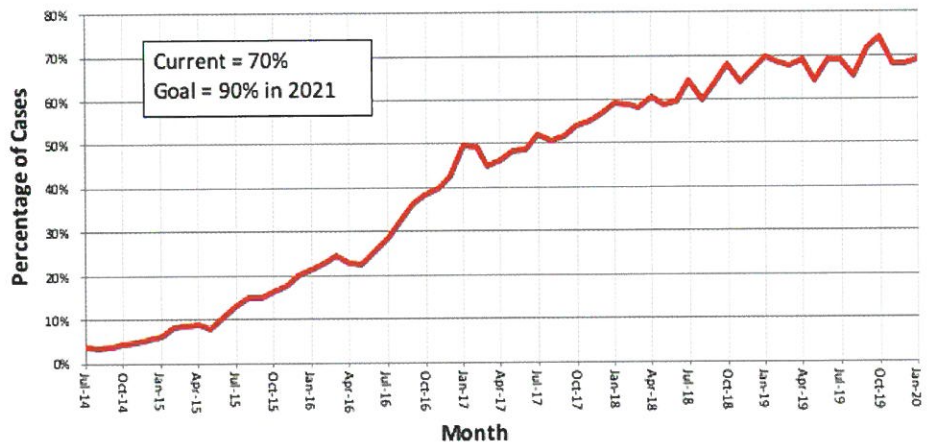


# INFORMATION TECHNOLOGIES

Suite of Web-based Applications for Submissions and Results



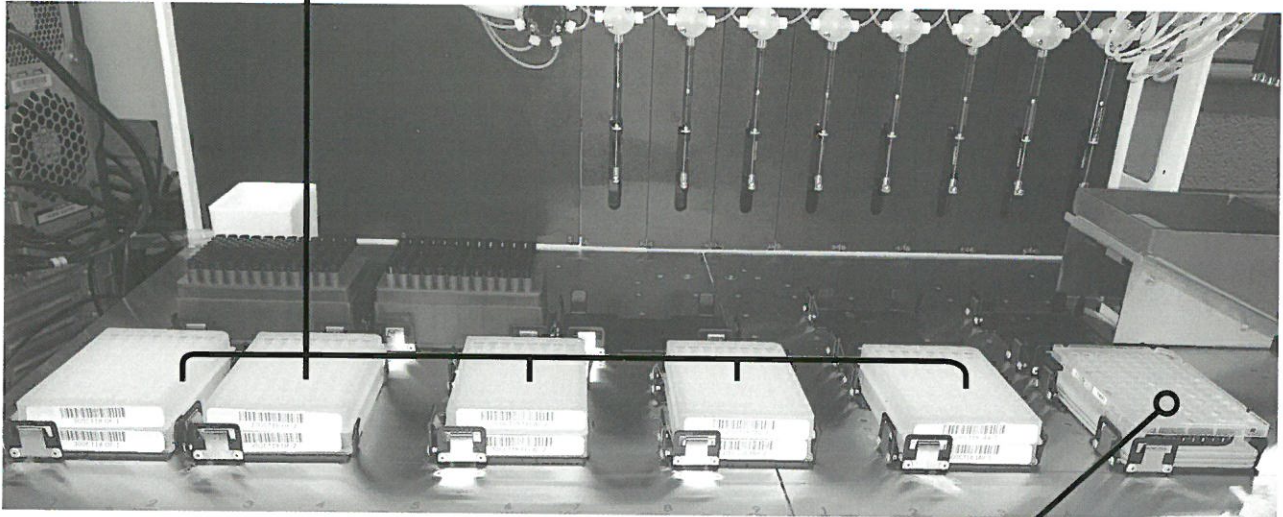
Percentage of Cases Submitted Electronically



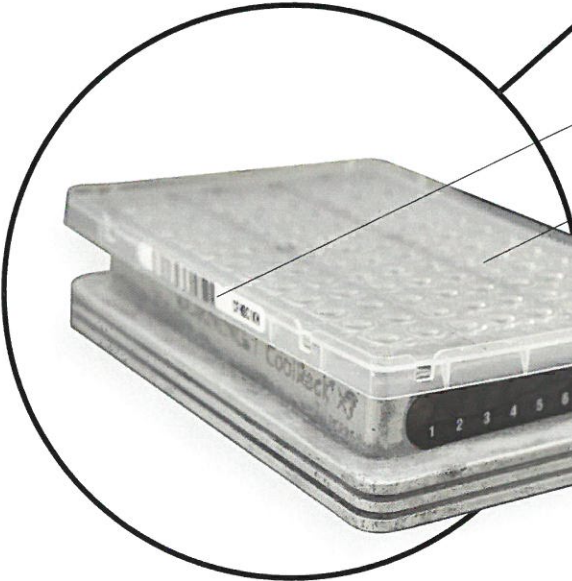


Extraction plates

Extraction plate barcode



The Iowa State University Veterinary Diagnostic Laboratory has the **1st fully integrated molecular diagnostic workflow in the United States.**



PCR plate barcode

PCR plate



# SWINE



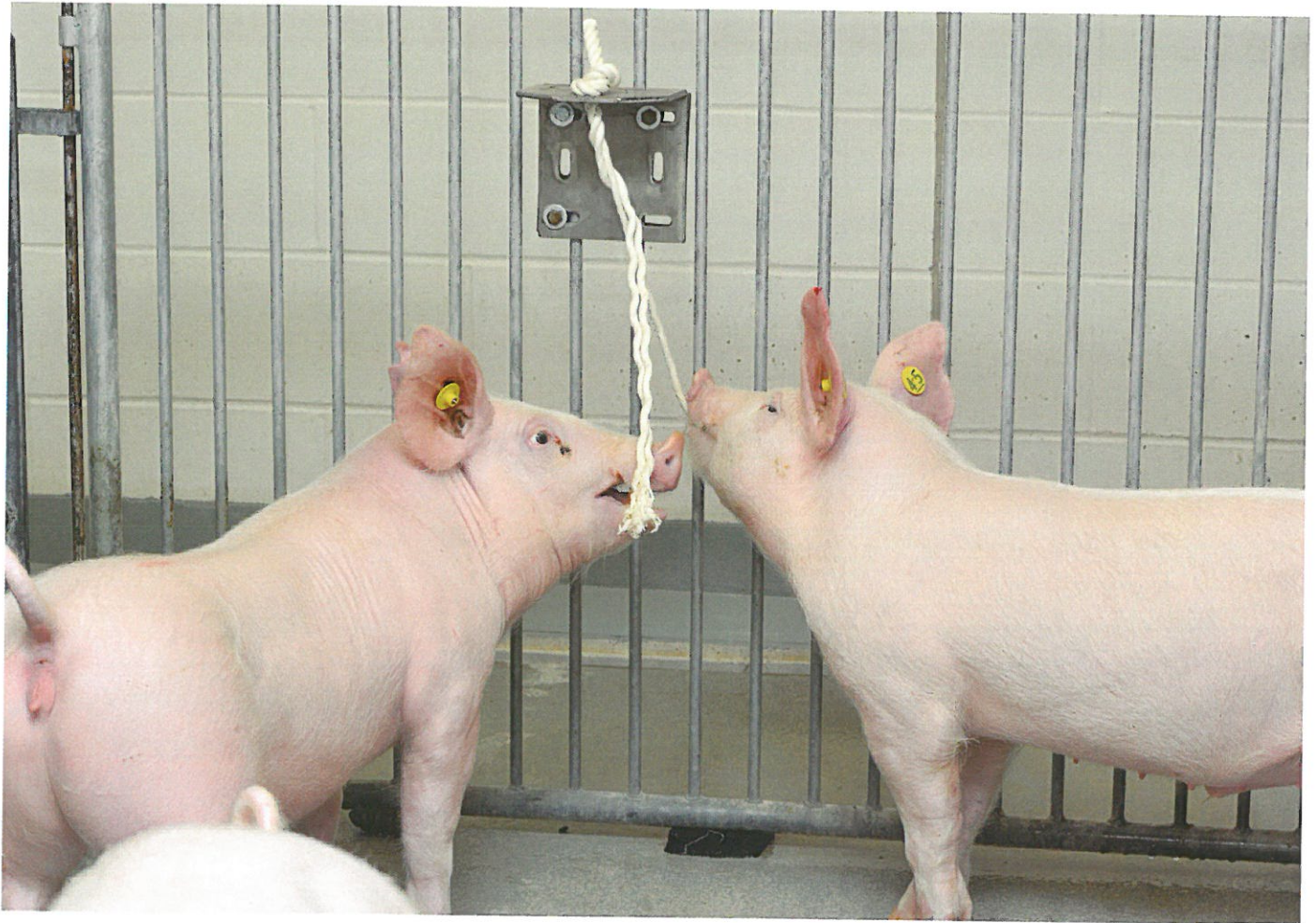
## PROCESSING FLUIDS

Linhares et al, ISU CVM

Exudate (fluid) from testicles and tails collected from young piglets is now being used as a highly sensitive sample type for determining the health status of breeding herds.

2017	—	1,000 tests
2018	—	19,341 tests
2019	—	37,280 tests



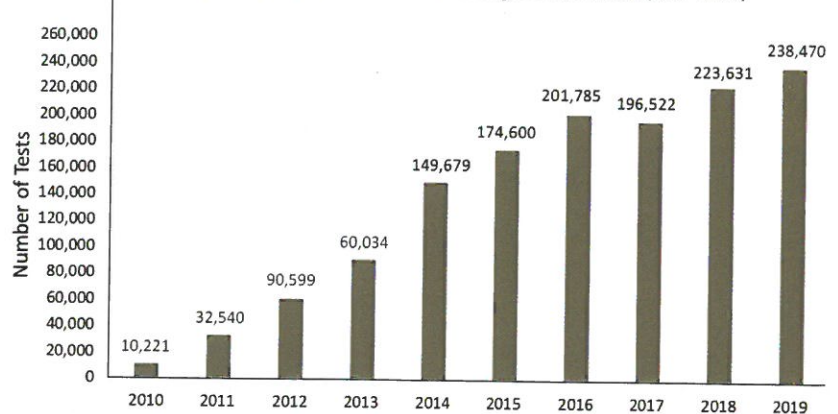


## SWINE ORAL FLUIDS

Zimmerman et al, ISU CVM

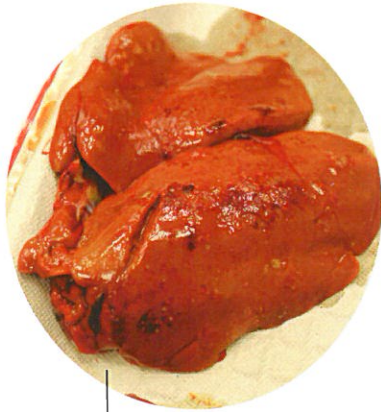
Saliva (oral fluid) collected from cotton ropes hung in swine pens has become the primary sample type used to detect the presence or absence of diseases in growing pigs.

Number of Swine Oral Fluid Diagnostic Tests (ISU VDL)

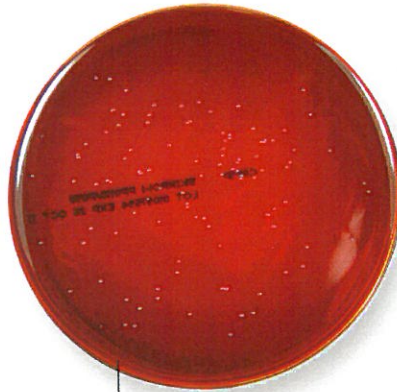




# POULTRY



Liver lesions present



Campylobacter colonies grown on Blood agar



Campylobacter organism



## SPOTTY LIVER DISEASE

(*Campylobacter hepaticus*)

First diagnosed in the United States in 2017

Liver lesions present

Increases mortality

Decreases egg production

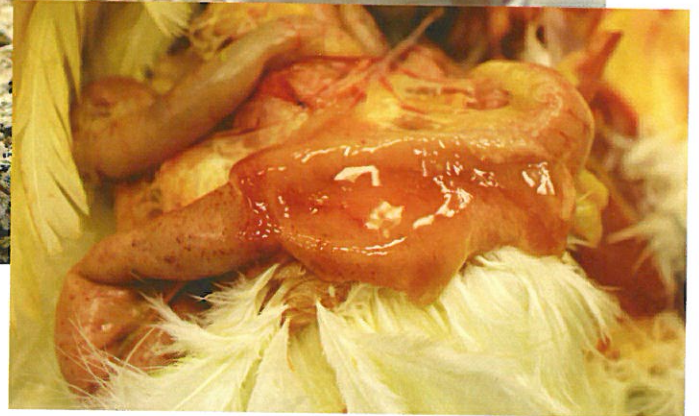
More frequently diagnosed in floor raised birds

Iowa State University researchers are investigating ways to develop rapid diagnostic tools and effective vaccines against Spotty Liver Disease (SLD)





Restricted antibiotic use exacerbates impact



Causes necrotic enteritis and diarrhea

## COCCIDIOSIS

Protozoal disease

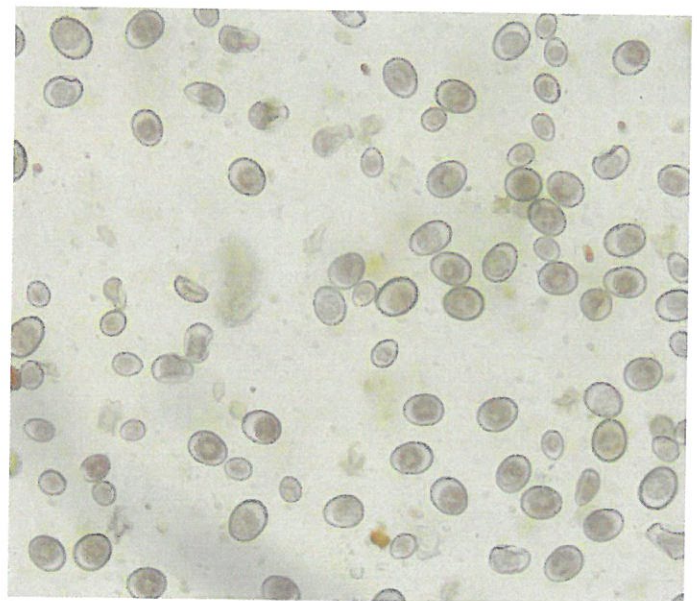
Diarrhea

High morbidity

Low growth  
Low feed efficiency

Fecal – Oral

#1 disease impacting growing birds

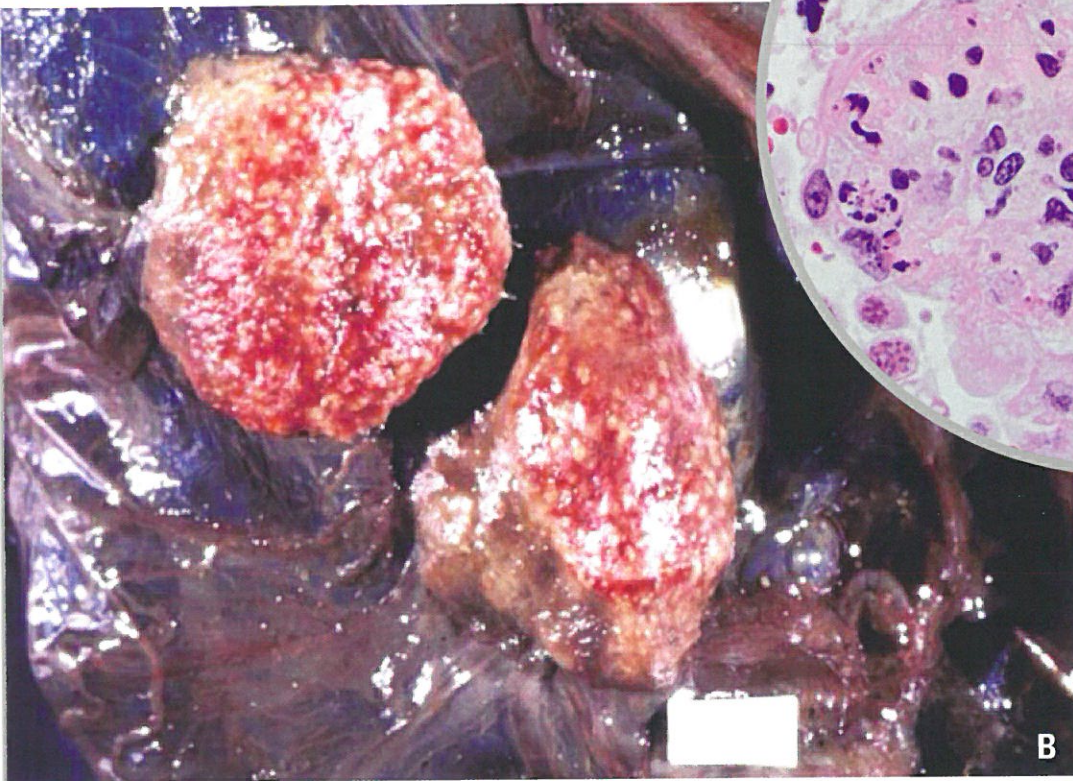
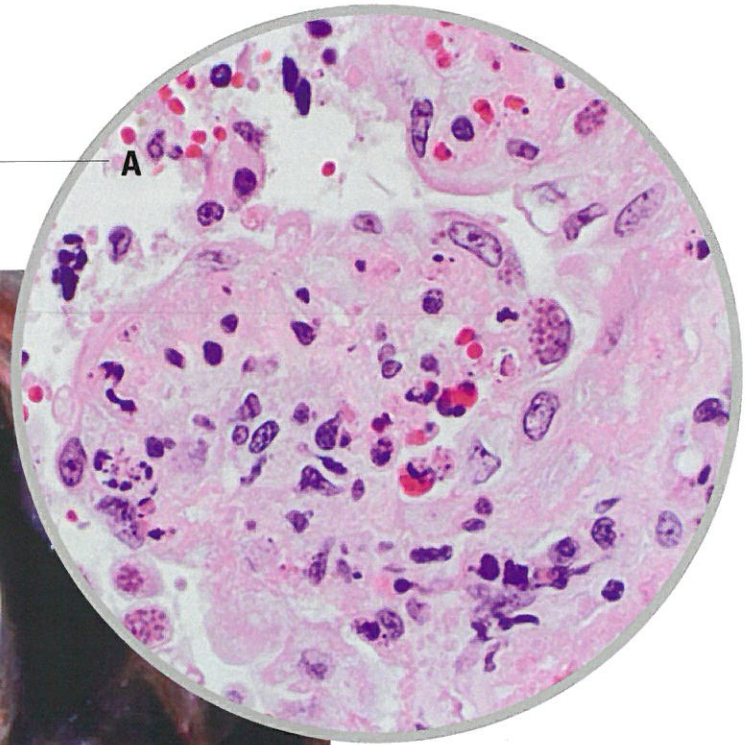


Microscopic image of cocci



# RUMINANT

**A** – Ewe placenta  
microscopic lesion



**B** – Placenta  
gross lesion

## TOXOPLASMA

### Abortion in Sheep

3 fetuses & 1 placenta submitted

Toxoplasma PCR+

Impact

Prevention (Cats)

Human Health (Zoonotic)

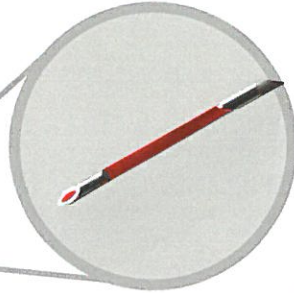
Initiate Treatment



## TRACE MINERALS

Important for Health & Immune System

Liver biopsy	Determines status	<table border="1"> <tr> <td>Deficient</td> </tr> <tr> <td>Adequate</td> </tr> <tr> <td>Toxicities</td> </tr> </table>	Deficient	Adequate	Toxicities
Deficient					
Adequate					
Toxicities					



## BOVINE VIRAL DIARRHEA (BVD)



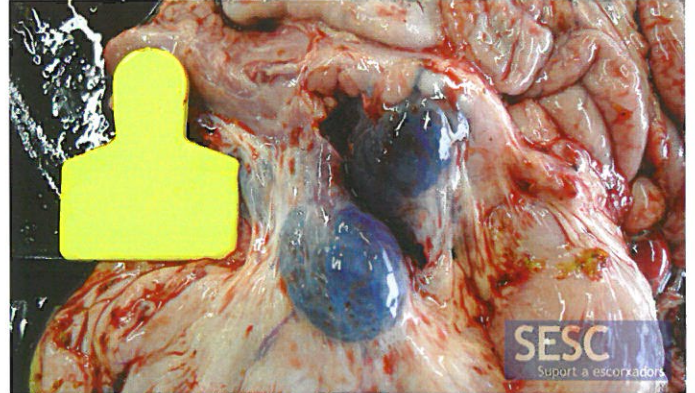
\*Pink Stain is BUO+

Ear notch — Paraffin wax — Stained slide — IHC slide

Screening for Persistently Infected (PIs)	Introduction into feedlot > \$100/head
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# AFRICAN SWINE FEVER



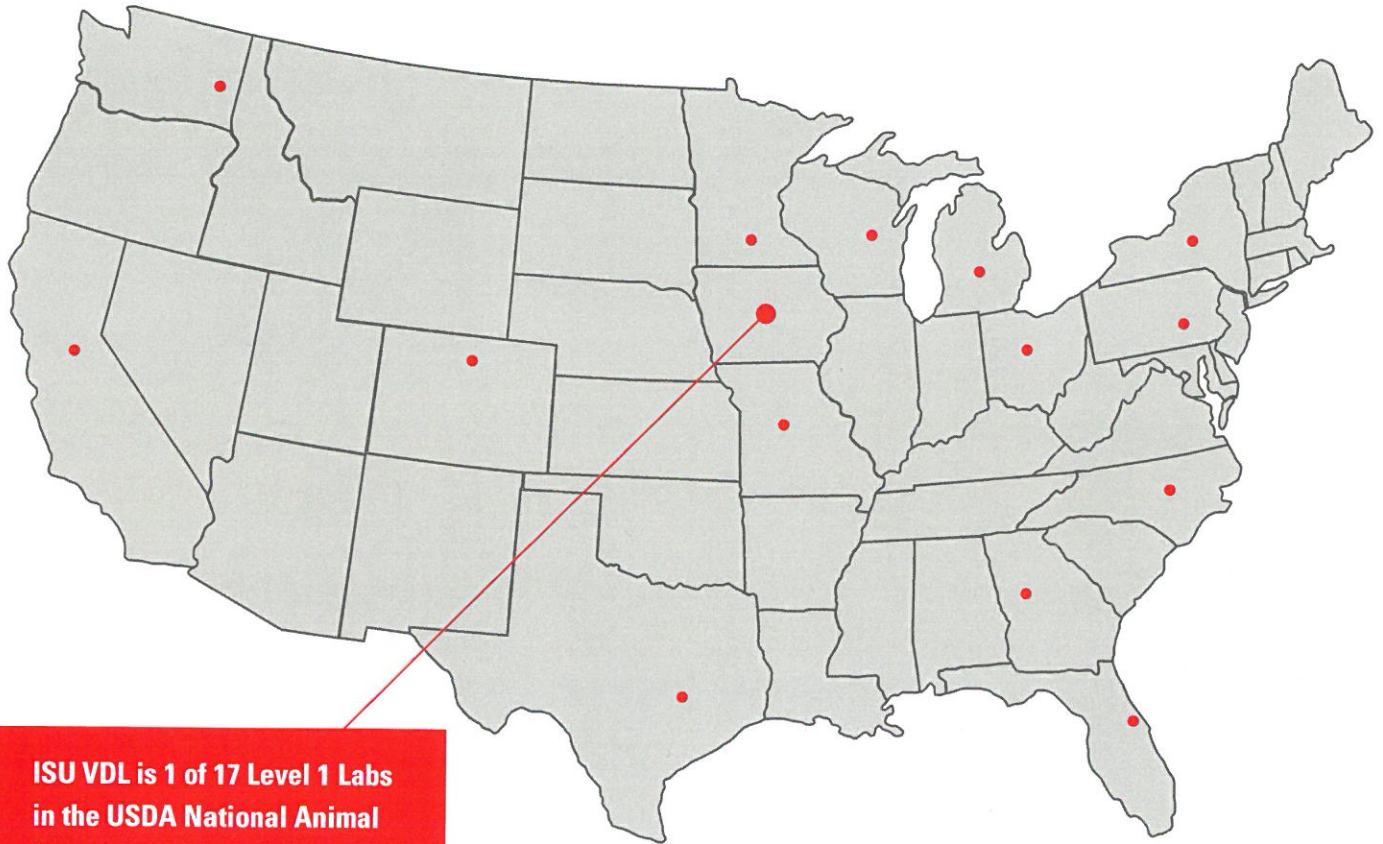
## AFRICAN SWINE FEVER

(Animal Health Crisis in Asia and parts of eastern Europe)

Highly resistant virus	High morbidity	High mortality
Depopulation of affected sites	 <b>TRADE IMPACTING DISEASE</b>	
Not a human health concern		








# NAHLN LEVEL 1 LABS



**ISU VDL is 1 of 17 Level 1 Labs in the USDA National Animal Health Lab Network**

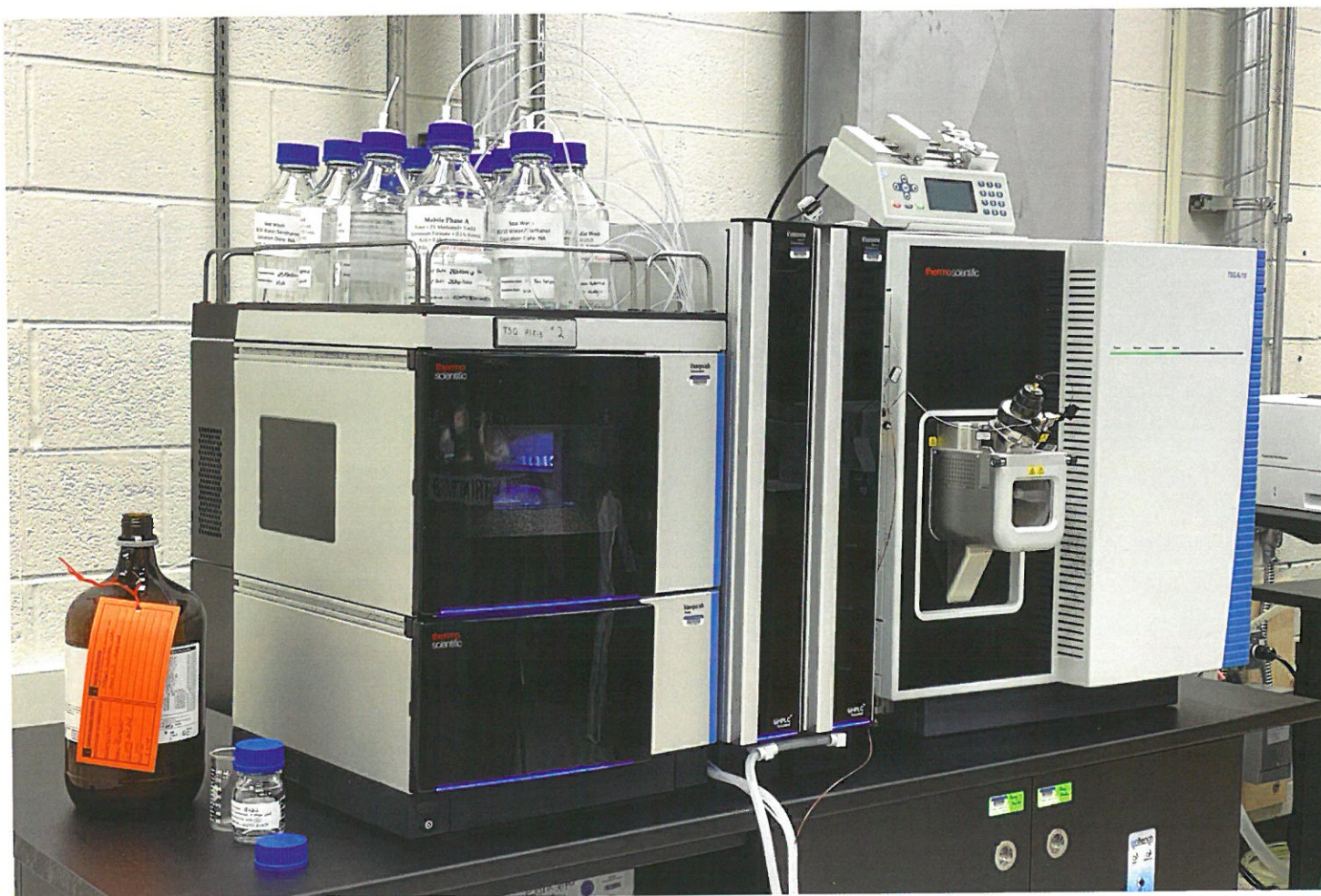
## FRONTLINES OF FOREIGN ANIMAL DISEASE

Surveillance and Response

	African Swine Fever (ASF)
	Classical Swine Fever (CSF)
	High-Path Avian Influenza Virus (HP- AIV)
	Foot and Mouth Disease (FMD)
	Exotic Newcastle Disease (END)



# ANALYTICAL CHEMISTRY



## MASS SPECTROMETRY

Drugs	Toxins
Nutrients	Heavy metals

One of only a few  
labs in the U.S. with  
these capabilities

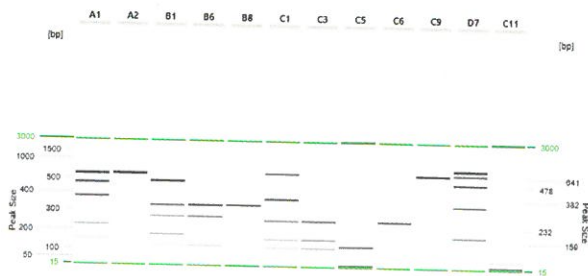


# SEQUENCING TECHNOLOGIES

## Sanger



Sample gets entered into the QiaXL machine

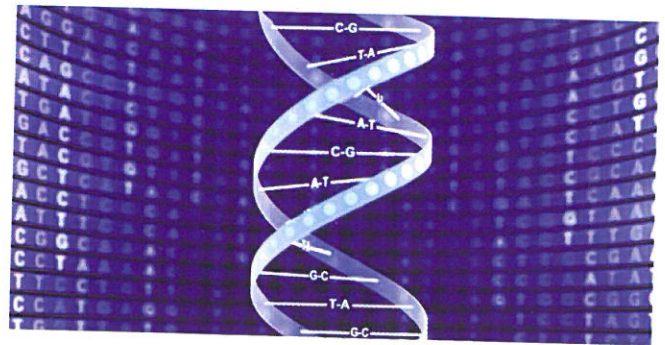


Gel electrophoresis



Sequencing machine

## Next Generation Sequencing



## APPLICATIONS

Epidemiologic purposes

Vaccine selection

Differentiate wild type from vaccine virus

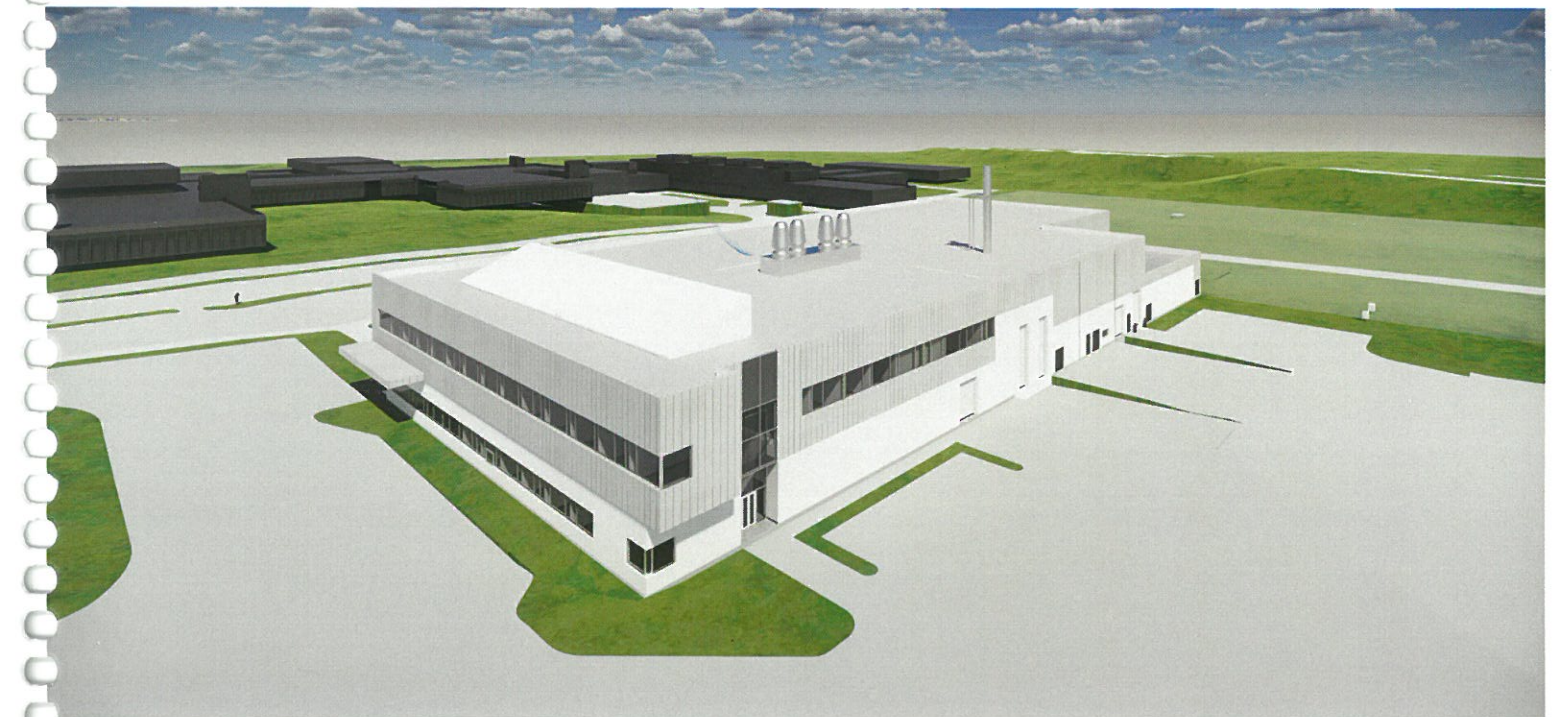
Vaccine production



# NEW VDL BUILDING PROJECT











# IOWA STATE UNIVERSITY

## **Veterinary Diagnostic Laboratory**

**Dr. Dan Grooms, *Dean*** | 515-294-1242

**Dr. Pat Halbur, *VDPAM Chair and VDL Executive Director*** | 515-294-6970

**Dr. Rodger Main, *VDL Director*** | 515-294-6945



**\$4.4M** Currently the ISU VDL receives an annual \$4.4 million appropriation, approximately 18% of the overall budget for the lab.

- Compared to peer labs, **the percentage of budget the ISU VDL derives from fees** charged to clients is among the highest in the nation.
  - > ISU VDL receives 18% of its budget from state appropriations.
  - > 85% of all state VDL's receive in excess of 20%.
  - > Average funding level is 44% of budget.
  - > 8 labs receive more than 60%.
- Baseline funding is critical to sustain a level of preparedness.
  - > To respond to disease outbreaks such as Avian Influenza, African Swine Fever, and Foot and Mouth Disease.
  - > To recruit and retain the quality and level of staffing for appropriate response.
  - > To keep tests affordable and encourage routine testing. Increased utilization of the lab facilitates early detection of disease and decreased "spillover" to neighbors.
- A recently published study estimated that \$31.79 million in state taxes are generated from the lab in normal years and \$124.15 million in state taxes are generated in times of an animal health emergency. This equates to a 8:1 return on investment during normal years and a 31:1 return on investment during times of an animal health emergency. [vetmed.iastate.edu/article/economic-contribution-isu-vdl](http://vetmed.iastate.edu/article/economic-contribution-isu-vdl)





**The \$4.4 million direct appropriation through Agriculture and Natural Resources allows the VDL to:**

- Continue to provide unbiased, critical diagnostic services to meet the needs of Iowa animal owners and the public.
- Position Iowa to continue to participate in national animal health networks and surveillance programs for important diseases.
- Serve as 1 of 17 Level 1 labs in the U.S. National Animal Health Laboratory Network.
- Detect and capably respond to the introduction of transboundary (porcine epidemic diarrhea virus 2013-14), foreign animal diseases (highly pathogenic avian influenza virus 2015), and emerging diseases of animals (Senecavirus A 2015-16, CWD 2019) and humans.
- Provide the research infrastructure to be the nation's leader in food-animal diagnostic medicine.
- Preserve and continue to grow Iowa's access to export markets: ~27% of U.S. pork, ~11% of U.S. beef, ~19% of U.S. chicken is exported.



**IMPACT: A 1% increase (or decrease) in Iowa's \$32.5 billion animal agriculture economy = \$325 million impact on Iowa**



# World-Class Veterinary Diagnostic Lab Needs a Suitable Facility

The Veterinary Diagnostic Laboratory (VDL) at ISU protects animal and human health and advances Iowa's \$32.5 billion dollar animal agriculture economy.

- Processes **90,000+ diagnostic cases/year, doubled in 10 years**
- Teaches the next generation of animal health professionals
- Conducts applied research of high relevance (animal health, food safety, zoonotic diseases)
- Plays a critical role in surveillance and response to foreign animal diseases (ASF, FMDV, HPAI)

LAND-GRANT MISSION

## SERIOUS INFRASTRUCTURE CHALLENGES

- 43 year-old facility, outdated HVAC, plumbing, electrical
- 1976: 10 faculty, 20 staff, 16,000 cases/year
- 2019: 25 faculty, 135 staff, 90,000+ cases/year, largest food animal caseload in U.S.
- Compromised biosafety & biocontainment
- Severe overcrowding

### Excerpts of External Review Panel Report:

*"...the space and structural limitations of this aging facility combined with the rapid growth of the laboratory will, in the opinion of this site team, limit the laboratory's ability to adequately respond to a large-scale foreign animal disease outbreak." – 2017 AAVLD Accreditation Site Visit Report*



Current VDL Facility Entrance

**IOWA STATE UNIVERSITY**  
Veterinary Diagnostic Laboratory

[vetmed.iastate.edu/vdl](http://vetmed.iastate.edu/vdl)





## SOLUTION: Build New Veterinary Diagnostic Laboratory

- **Thank you** for your support. We sincerely appreciate recognition of the impact and need with the \$63.5 million over 6 years (2019-2024) from Rebuild Iowa Infrastructure Fund.
- ISU worked with architects and engineers to bring 2014 program plans up-to-date.
  - ✓ Program space needs validated
  - ✓ Decrease from 151K gsf to 138K gsf
  - ✓ Construction cost/gsf comparable to other new VDLs
  - ✓ Space utilization efficiency increased from 55% to 63%
  - ✓ Total cost to meet expanding diagnostic program needs = \$126 million
- \$75 million project (\$63.5 Legislature + \$11.5 ISU and Donors) includes essential infrastructure and 50% (69K gsf) of the needed program space including:
  - ✓ Client Entrance
  - ✓ Necropsy
  - ✓ Pathology
  - ✓ Bacteriology
  - ✓ Receiving/Accessioning
  - ✓ Sample Processing
  - ✓ Histopathology
  - ✓ Incinerator
- Critical unmet needs (80% of testing) which will need to be addressed in the near future include:
  - ✓ Molecular Diagnostics
  - ✓ Virology
  - ✓ Analytical Chemistry/Toxicology
  - ✓ VDL Administration
  - ✓ Serology
  - ✓ BSL-3 Lab
  - ✓ VDL Research
  - ✓ IT/QA
- Thank you to Iowa Pork Producers Association and Iowa Farm Bureau for major lead donations to this project.
- The VDL provides outstanding return on investment by supporting the critical diagnostic needs necessary to support Iowa's animal agriculture industry and protect public health.

### IOWA STATE UNIVERSITY

College of Veterinary Medicine

VDL Economic Impact Study: [vetmed.iastate.edu/VDL-Economic-Impact-Study](http://vetmed.iastate.edu/VDL-Economic-Impact-Study)

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