Senecavirus A in swine

MVMA Lunch ’n Learn – March 28, 2017

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Outline

- Background
- Clinical disease
- Epidemiology
- Prevention and control
- Research

Senecavirus A Background

- Picornaviridae
  - Non-enveloped, (+) ssRNA virus

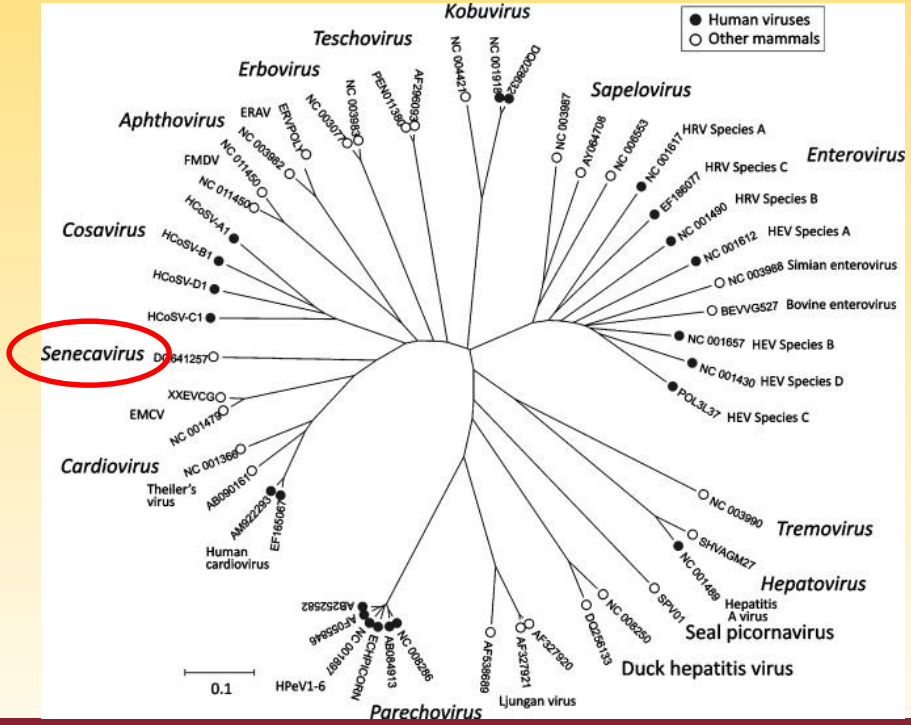


Figure 1. Harvala, H., and P. Simmonds. "Human parechoviruses: biology, epidemiology and clinical significance." *Journal of Clinical Virology* 45.1 (2009): 1-9.

Senecavirus A Background

- First characterized in a human research lab in 2002
  - Cytopathic contaminant in human fetal retinoblast cell cultures (Hales et al, 2008)
  - Unknown source
    - Porcine trypsin
    - Fetal bovine serum
  - Seneca Valley Virus – 001 (SVV001)
    - Species name: Senecavirus A

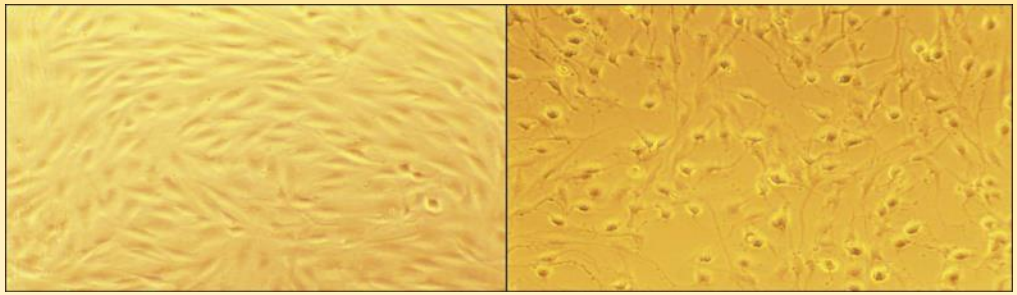
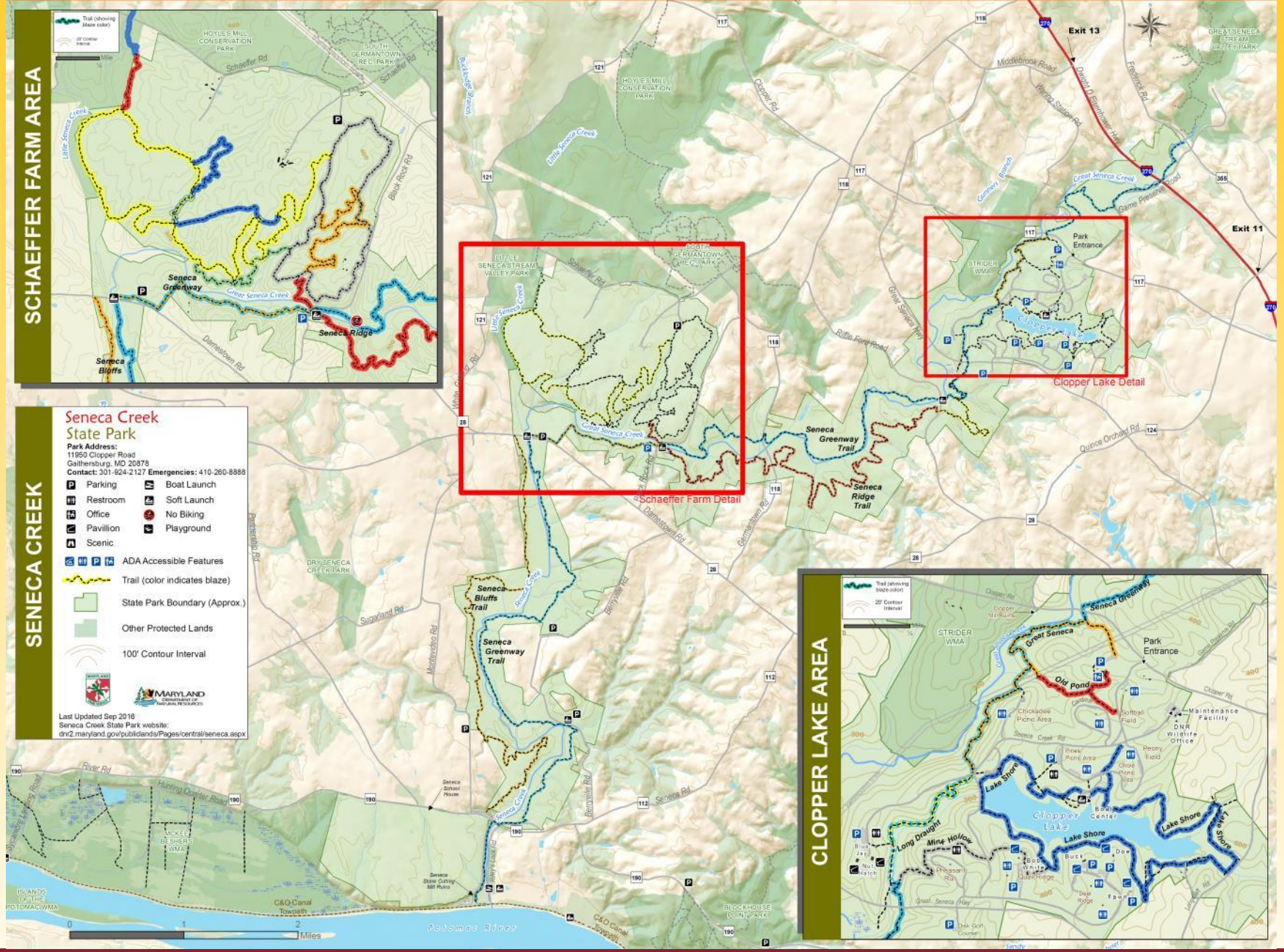


Figure 3.20. Markey. *Clinical Veterinary Microbiology, 2nd Edition*. Mosby



UNIVERSITY OF MINNESOTA
VETERINARY DIAGNOSTIC LAB

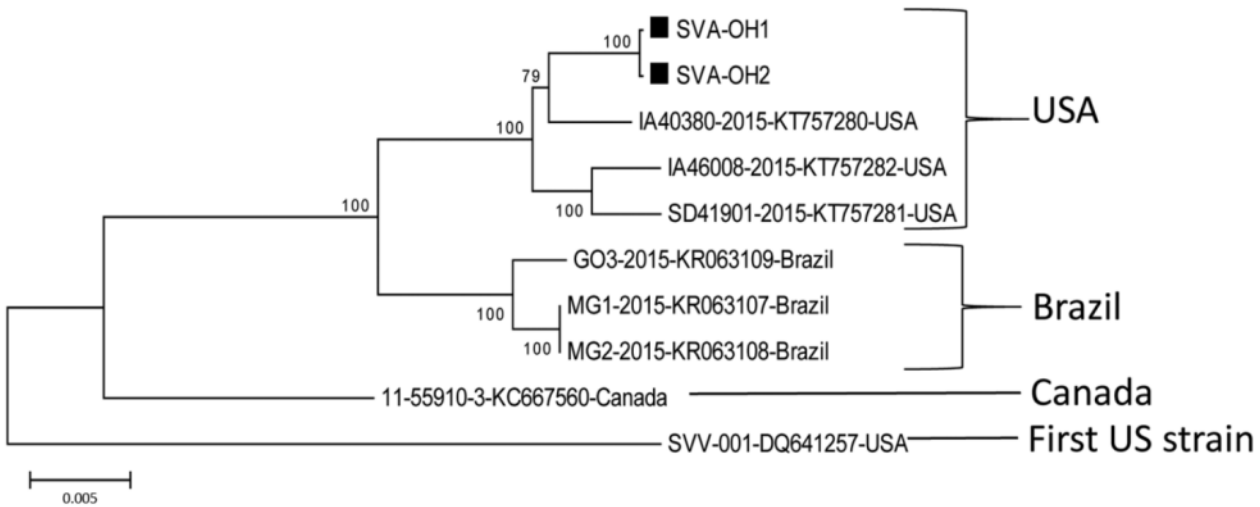
Senecavirus A Background

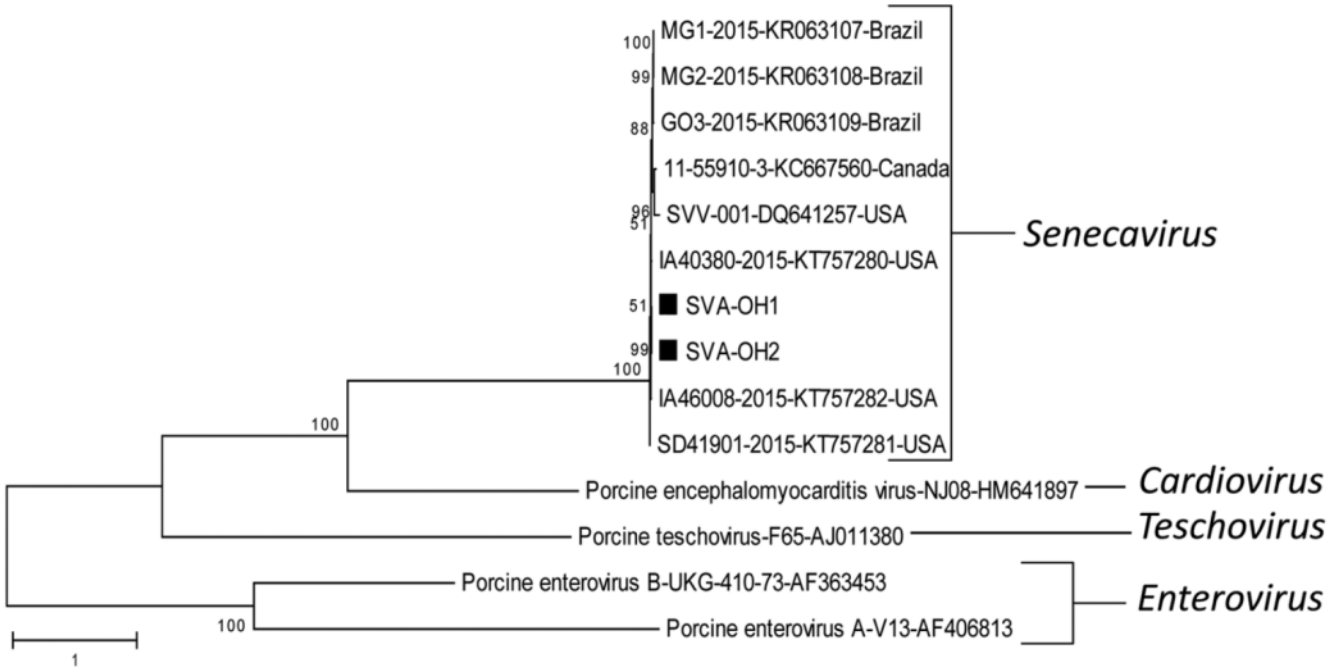
- Investigated as a human cancer therapy
  - Oncolytic virus with predilection for human neuroendocrine tumors
  - Capable of eliminating tumors in SCID mice
  - Clinical trials did not show significant responses in adults or pediatric patients
    - Seroconversion and clearance of virus

Senecavirus A Background

- Identified in swine with idiopathic vesicular disease
  - Canada
  - United States
- Isolated from swine tissues at NVSL back to 1988 (not characterized beyond Picornavirus initially)
- Outbreaks of disease reported starting in 2014
  - Brazil
  - United States
  - China

Pasma et al. 2008; Singh et al. 2012





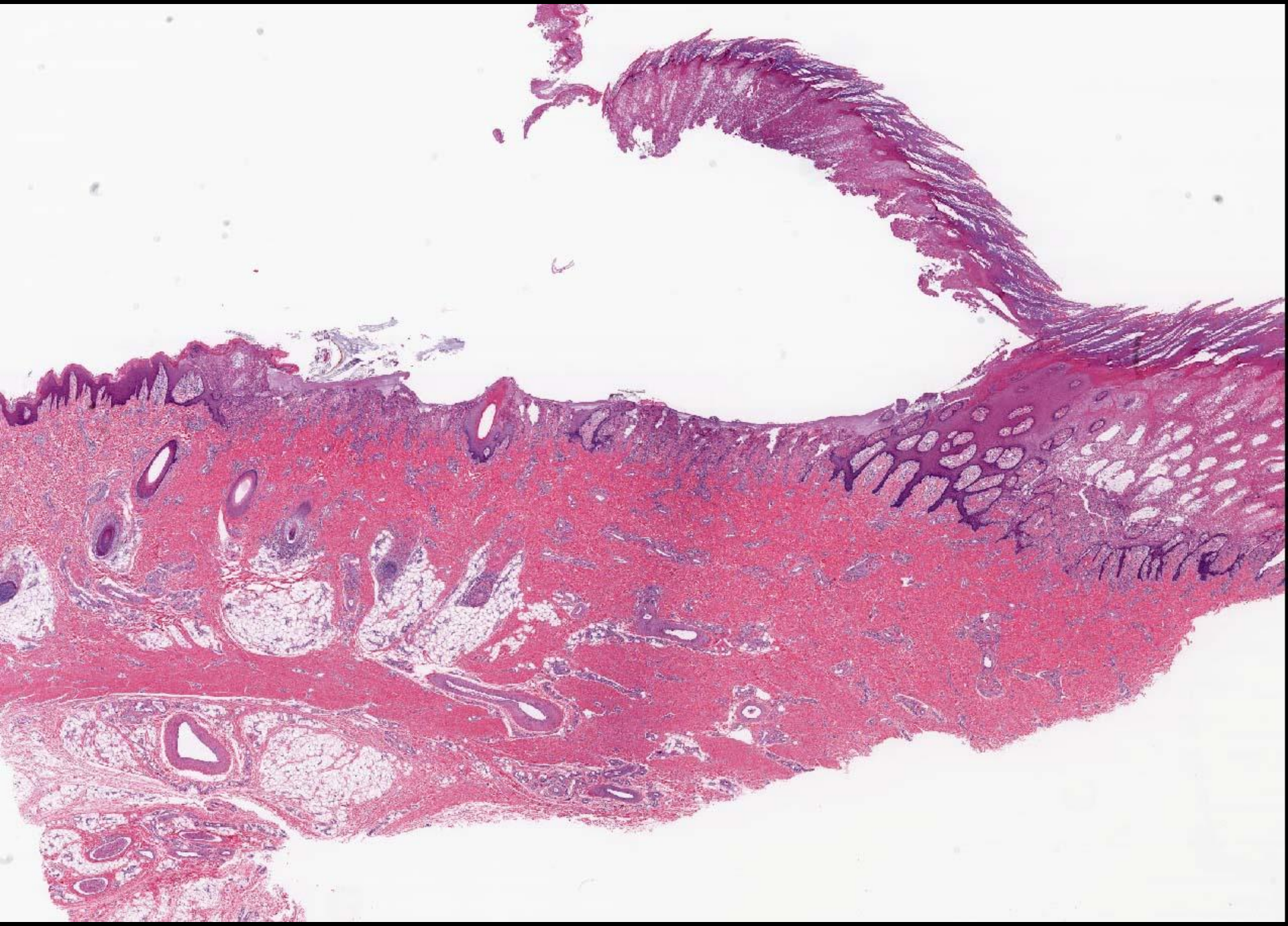
Wang L, Prarat M, Hayes J, Zhang Y. Detection and Genomic Characterization of Senecavirus A , Ohio , USA , 2015. *Emerg Infect Dis*. 2016;22(7):1321-1323.

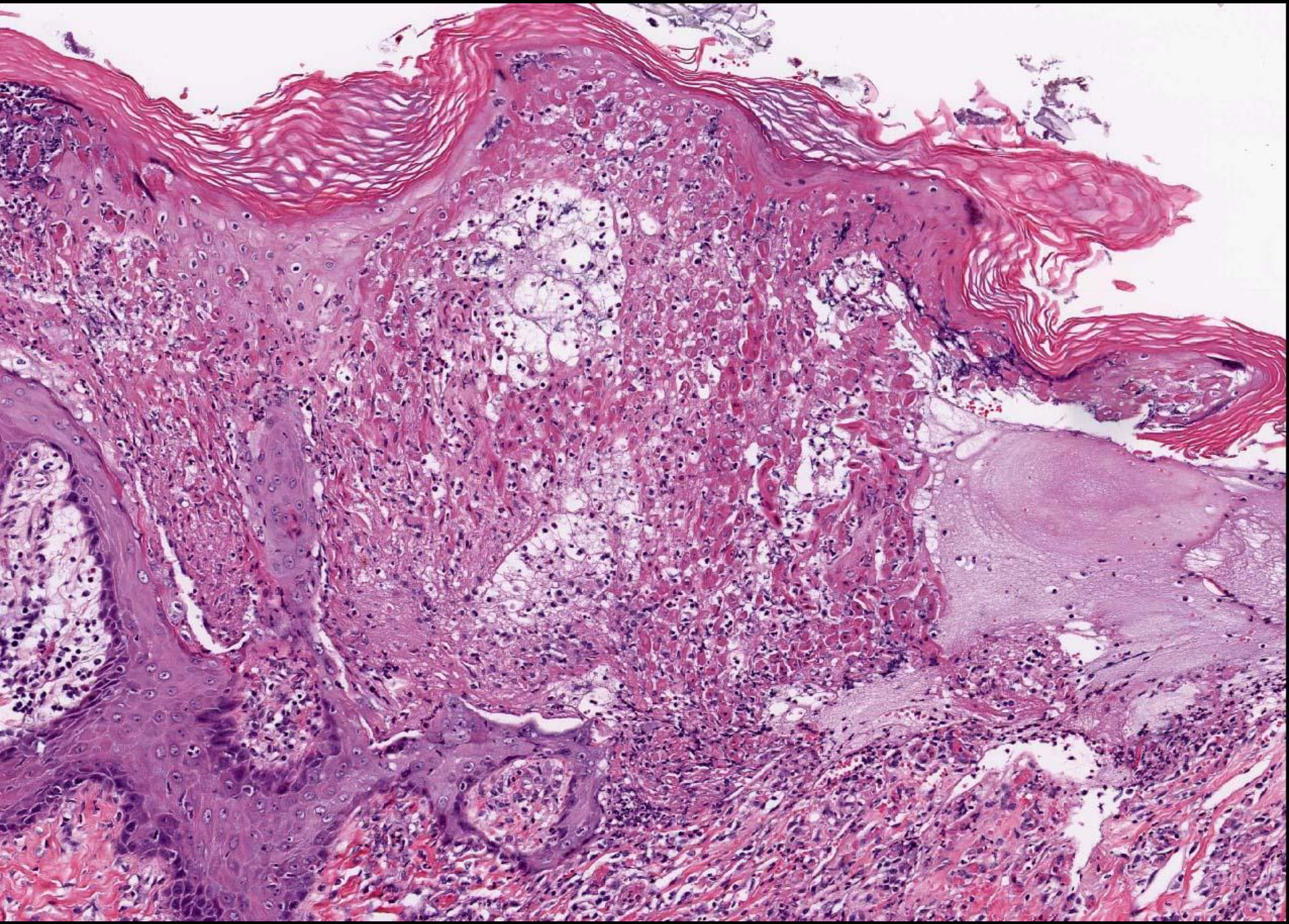
Senecavirus A - Disease

- Causes cutaneous vesicular lesions in pigs of all ages
  - Coronary bands, oral cavity, snout
  - Lameness, lethargy, anorexia and fever
- Associated with increased neonatal mortality
  - Weakness
  - Diarrhea
  - Sudden death
- Experimentally-induced disease in swine recently demonstrated

Vesicular disease

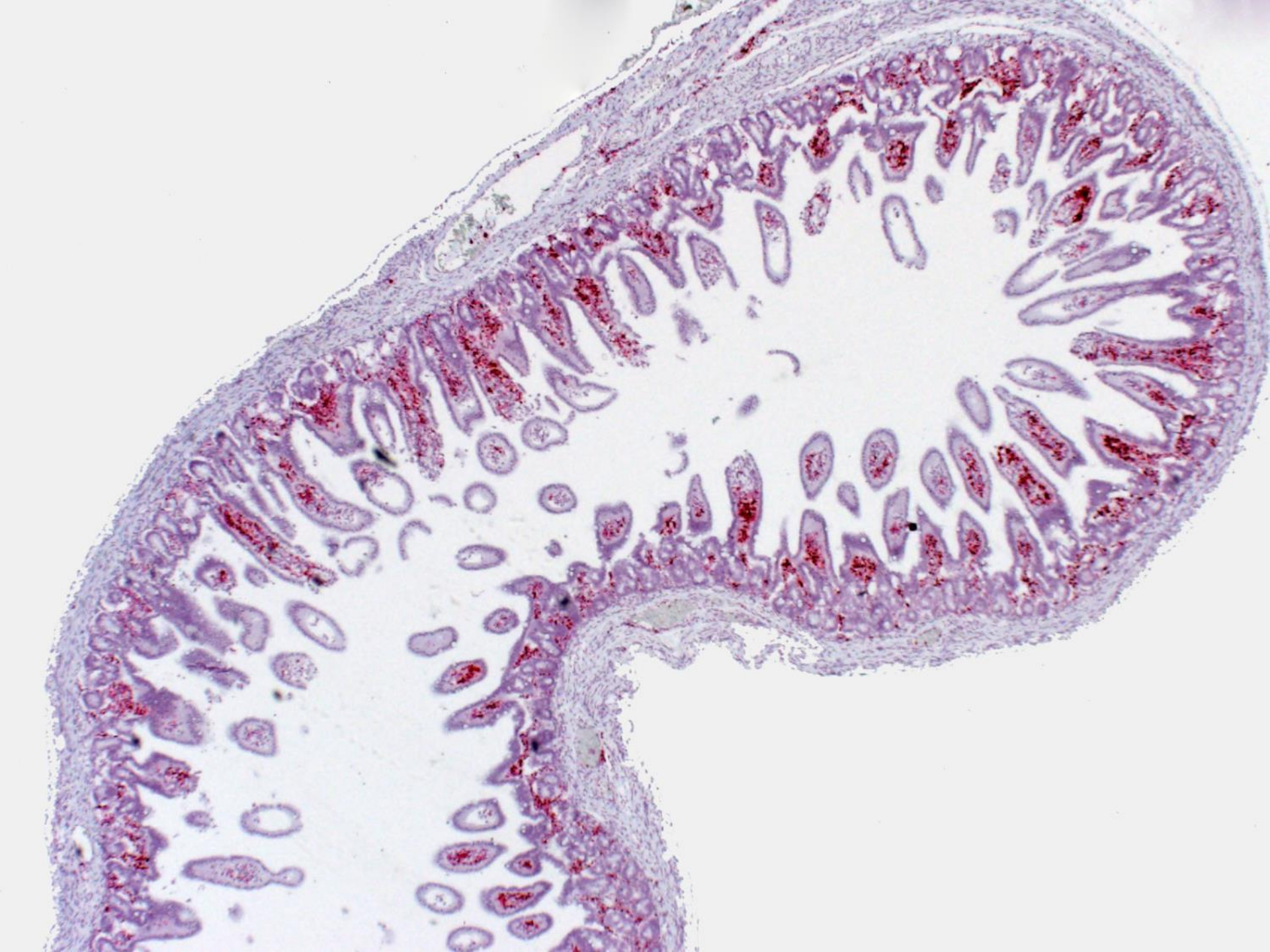
Vannucci FA, Linhares DCL, Barcellos DESN, Lam HC, Collins J, Marthaler D. Identification and Complete Genome of Seneca Valley Virus in Vesicular Fluid and Sera of Pigs Affected with Idiopathic Vesicular Disease, Brazil. *Transbound Emerg Dis*. 2015;62(6):589-593. doi:10.1111/tbed.12410.

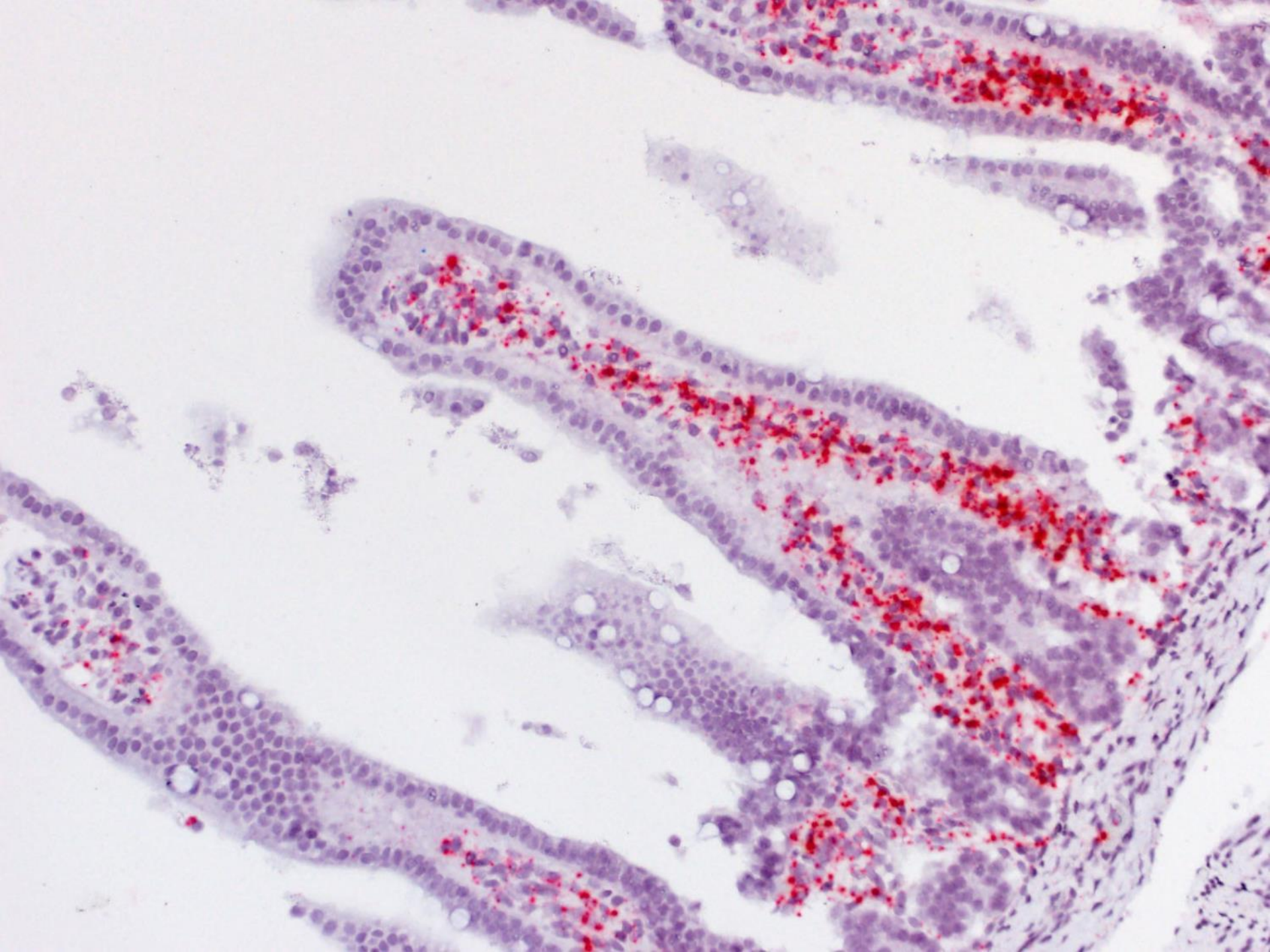




Neonatal mortality

Courtesy of F. Vannucci





Available Senecavirus A Diagnostics

- PCR
  - Vesicles (FAD investigation)
  - Secretions (nasal swabs, oral fluids, feces, semen)
  - Blood
  - Necropsy tissues (tonsil, spleen, lymph node, intestine)
- Serology
  - Indirect ELISA
  - Indirect Fluorescent Antibody (IFA)
- In-Situ Hybridization (ISH) – formalin-fixed tissues

Manifestations of disease/exposure

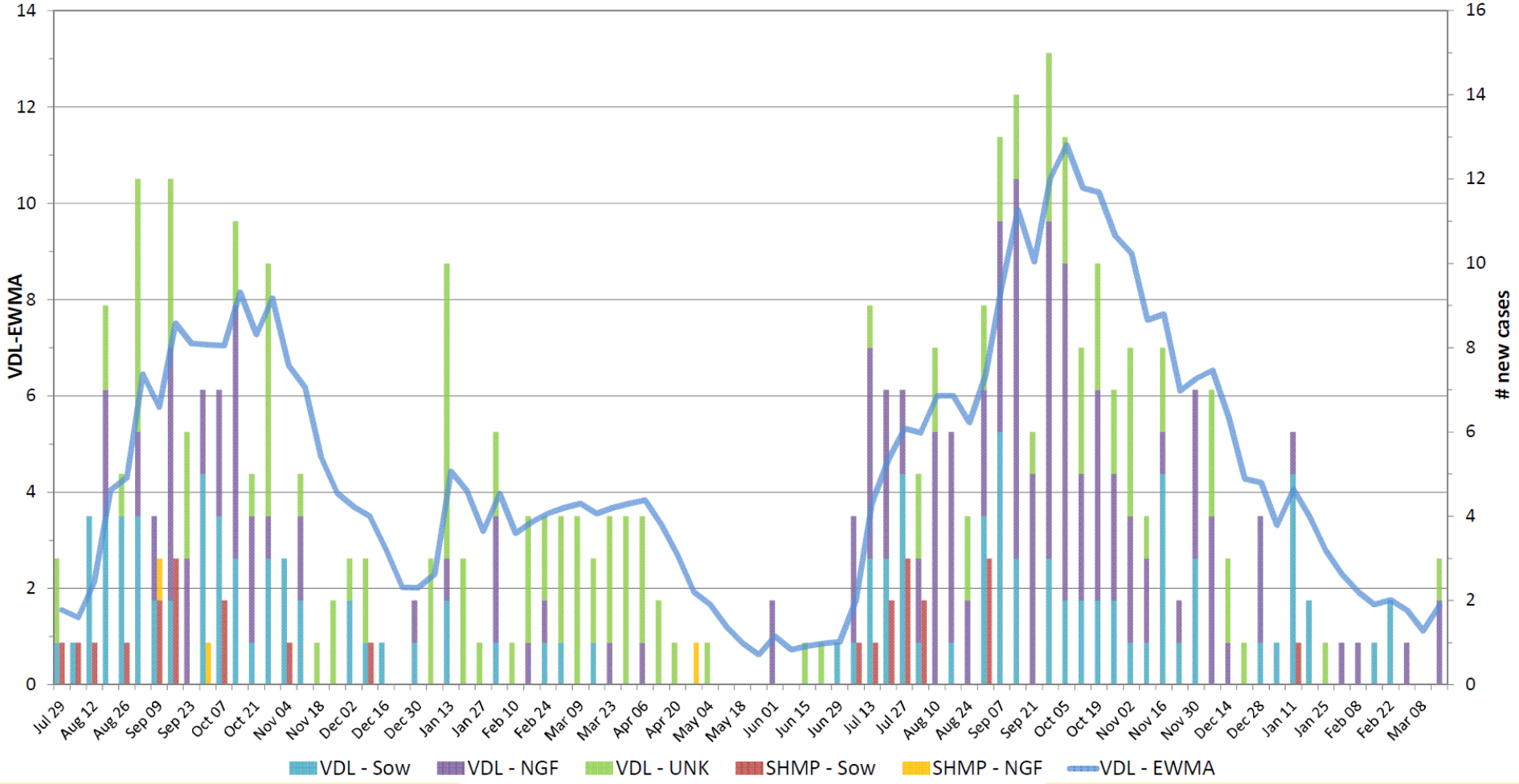
- Vesicles
  - Form ~3-7 days post-exposure
  - Rupture to form ulcerative lesions with resolution after ~14 days post-exposure
- Viremia
  - Short-lived (3-10 days post-exposure)
- Viral shedding – starts 1 day post-exposure
  - Oral fluids, nasal swabs, feces – up to 28 days
- Seroconversion
  - Neutralizing antibodies – detectable 3-5 days post-exposure
  - IgM – detectable from 5 days to 21 days post-exposure
  - IgG – detectable 7-10 days post-exposure

Chen et al. 2016; Joshi et al. 2016; Montiel et al. 2016

Senecavirus A Epidemiology

- Seasonal peaks of reported disease
  - Late Summer/Early Fall
- Minnesota cases are predominantly in southern part of the state
  - Mirrors major swine producing areas
- Often reported in finishing pigs and cull sows at slaughter inspection

Seneca Valley Virus frequency of VDL and SHMP cases by production type



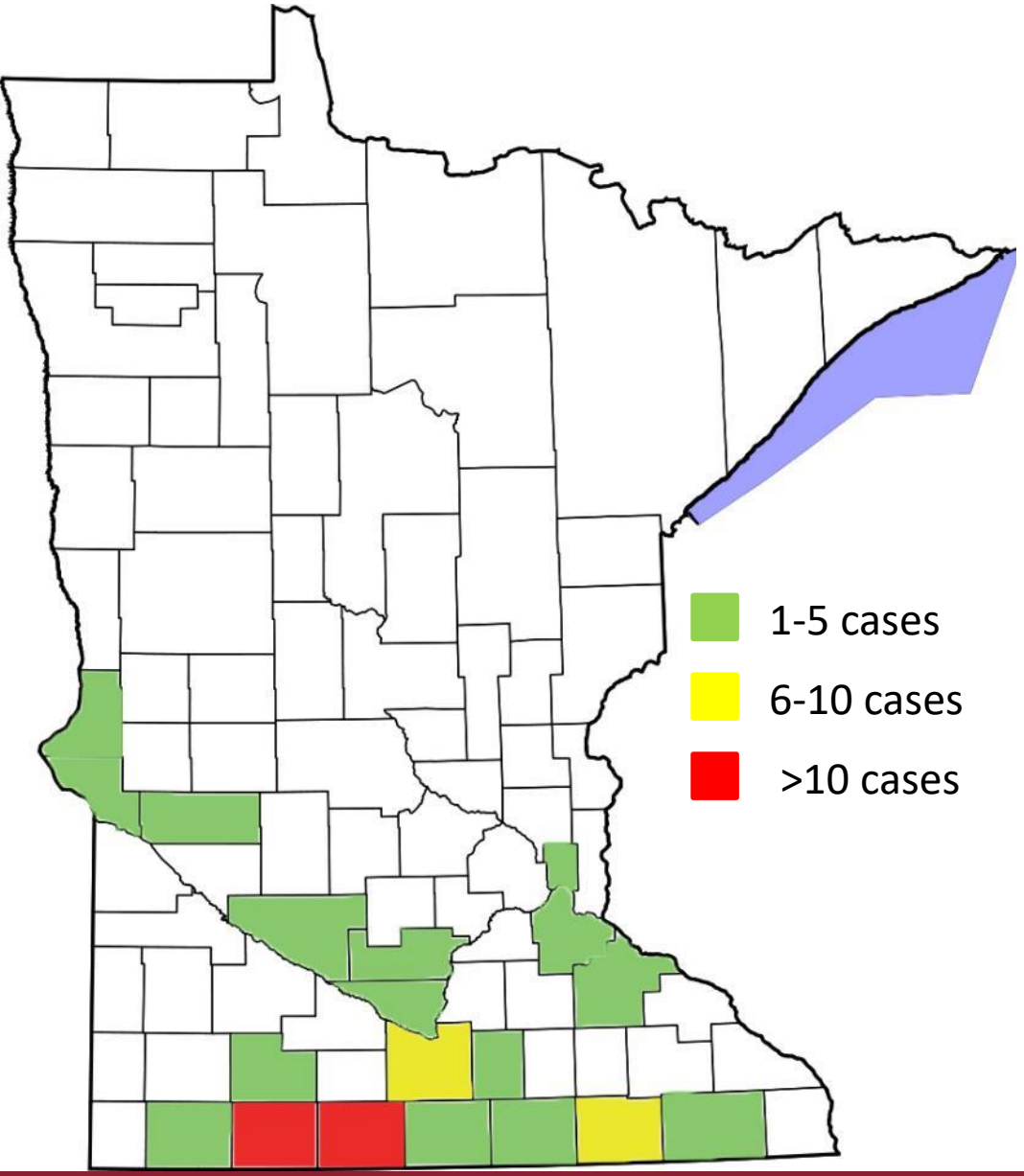
USDA SHIC Swine Health Information Center pork checkoff

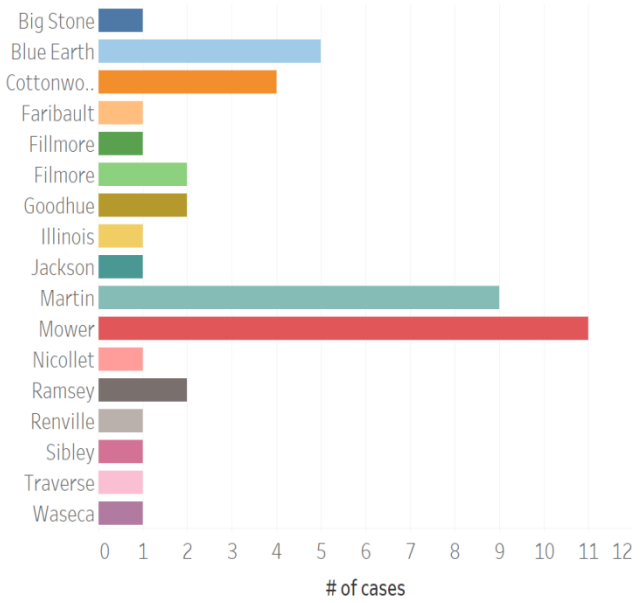
Swine Health Monitoring Project

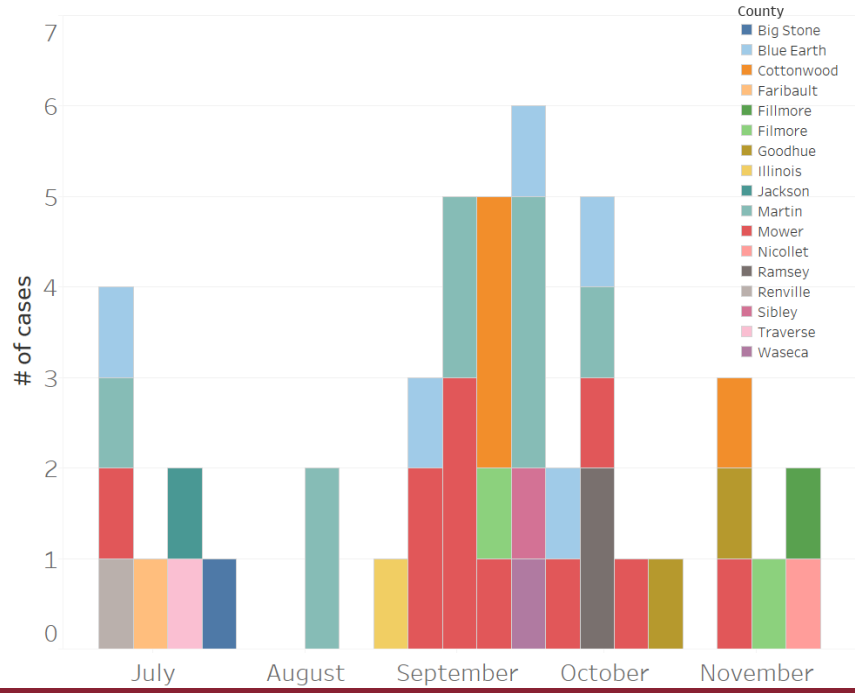
SHMP@umn.edu

3/17/2017

UMN VDL Senecavirus A PCR positive cases 2016-17







Treatment, Prevention, and Control

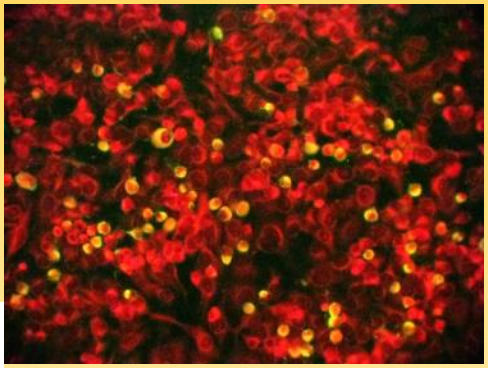
- Palliative treatment for lameness/pain
- No vaccine
- Biosecurity is key

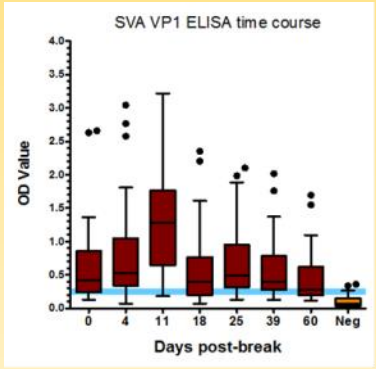
- Sow Farms
  - Herd closure
  - Mass exposure via feedback

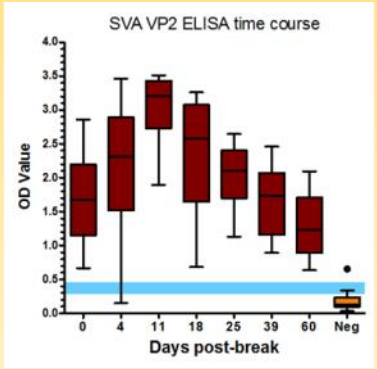
- Finishing sites
  - Allow lesion resolution prior to market
  - Site sanitation between groups

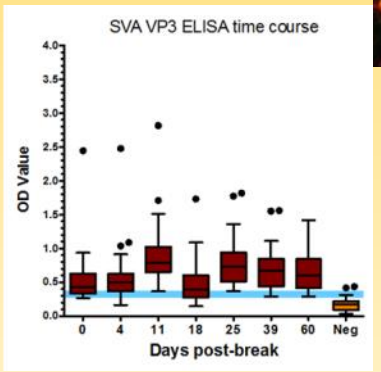
UMN Research

- UMN Veterinary Diagnostic Laboratory
  - Serology
    - Indirect Fluorescent Antibody
    - VP2 ELISA (with Murtaugh Laboratory)

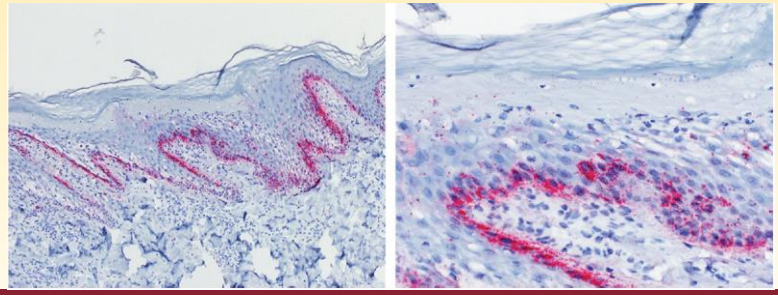








  - In-situ Hybridization



UMN Research

- 2016 - Pilot investigation in a packing plant – detection by PCR

Sample type	Frequency of detection
Oral fluids – pigs in waiting pens (n=14)	3/14 (21%)
Environment – pen railings and unloading docks (n=30)	9/30 (30%)

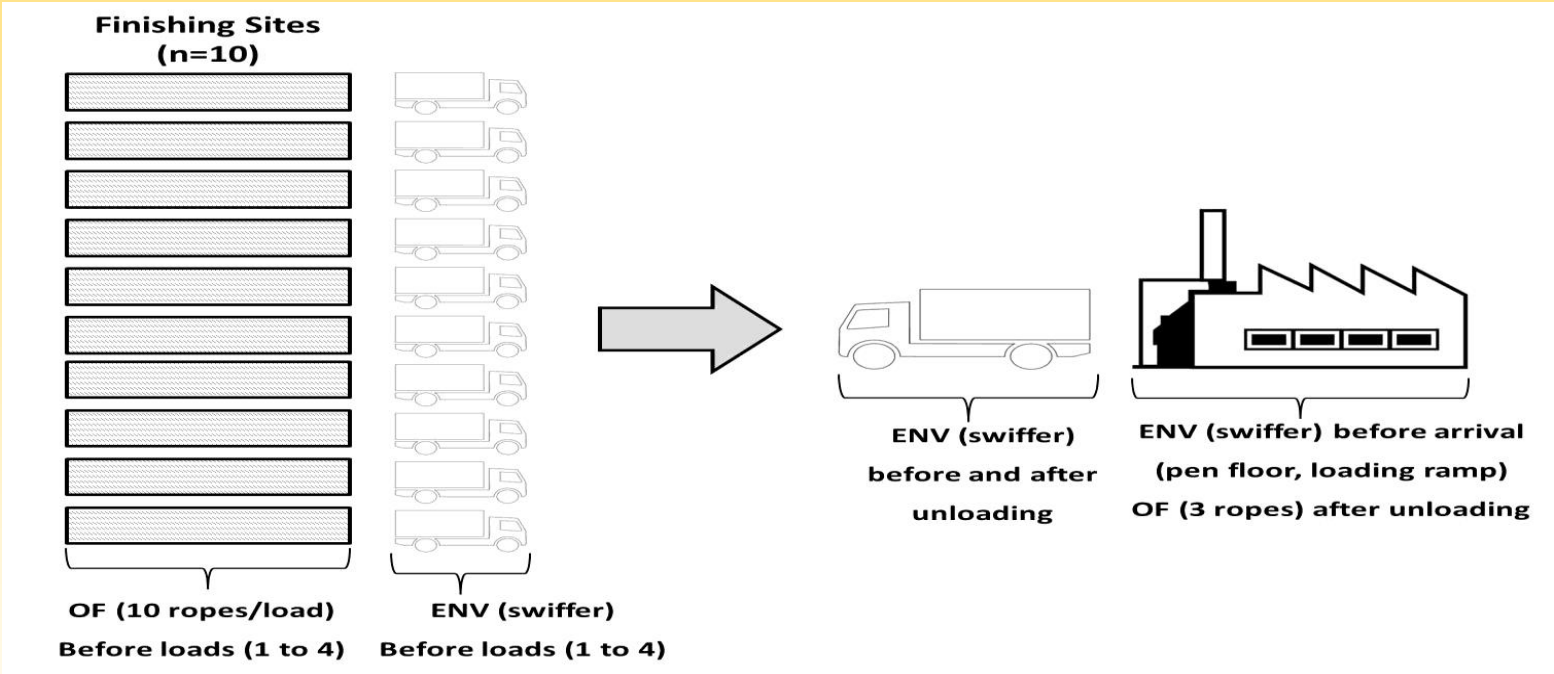
* Virus isolated from one environmental sample

UMN Research

- Funded proposals - 2017
  - Transmission of Senecavirus A by artificial insemination
    - Evaluate shedding in semen of infected boars
    - Determine if transmission may occur via artificial insemination
  - Transmission of Senecavirus A in pregnant sows
    - Evaluate for vertical transmission
    - Reproduce neonatal mortality

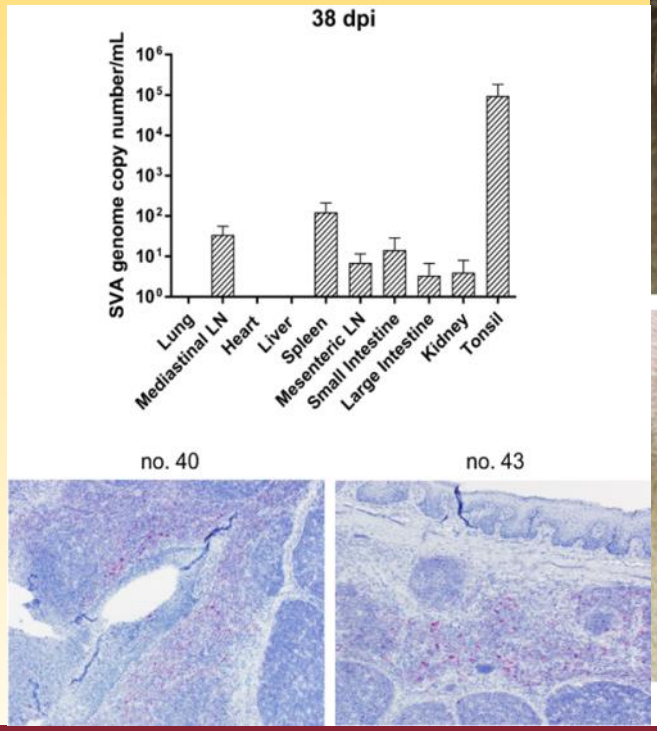
UMN Research

- Proposed research – 2017
  - Evaluation of oral fluids and environmental samples for monitoring Senecavirus A in finishing pigs, transport vehicle and packing plants



UMN Collaborations

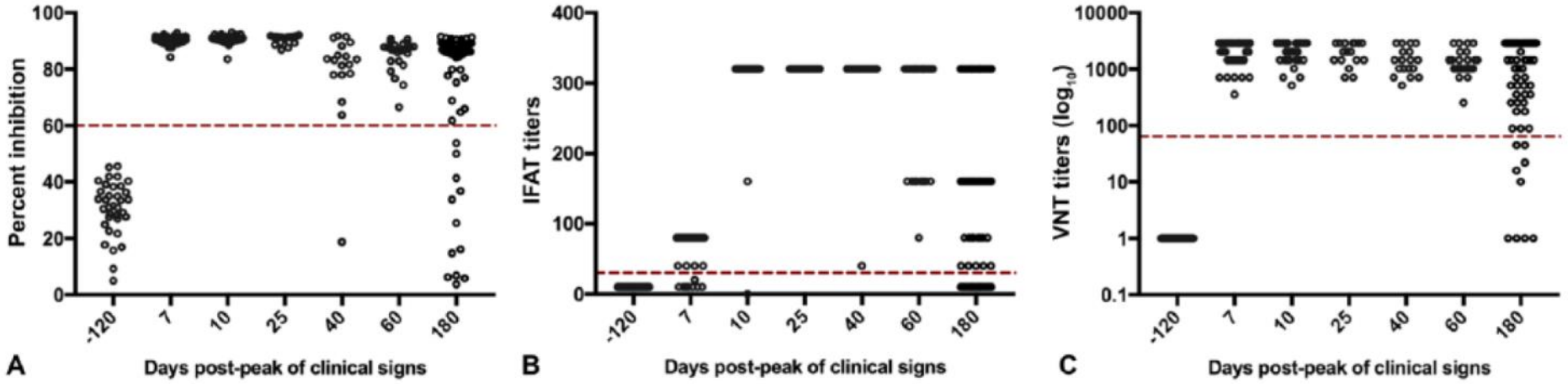
- SDSU – Experimental reproduction of vesicular disease



Joshi et al. 2016

UMN Collaborations

- Canadian Food Inspection Agency – Manitoba
  - Validation of cELISA and Virus Neutralization tests



Goolia et al. 2017

Why Should You Care?

- Senecavirus A clinical disease is indistinguishable from other reportable diseases (FMD, VS, SVD, VES) with similar immediate implications
  - Quarantine of affected sites
  - Shut-down of slaughter/packing plant
  - Morbidity and mortality losses to producer

Reporting Vesicular Disease

- Minnesota Board of Animal Health
  - (651) 296-2942 : Business hours
- Minnesota Duty Officer
  - (800) 422-0798 : After hours
- USDA – St. Paul Office
  - (651) 234-5680

Conclusions

- Senecavirus A is an emerging pathogen in swine
- Senecavirus A causes vesicular disease in swine and has been associated with neonatal mortality
- Further research is necessary and ongoing

Questions?