Influenza D: identification of a new subtype and its implications

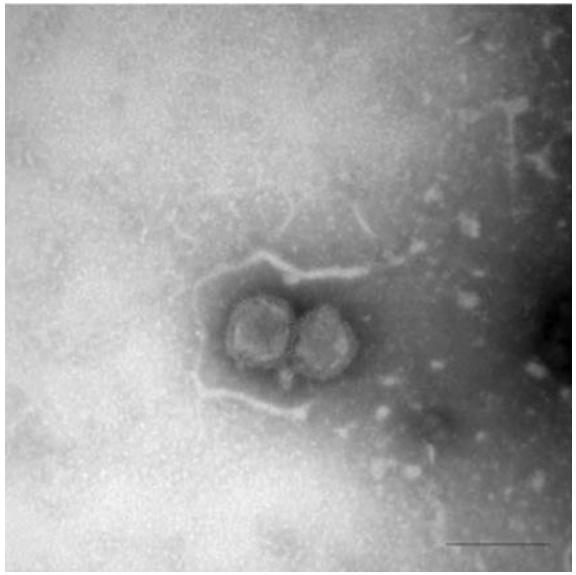
Natalie Thiex, Ph.D., MPH

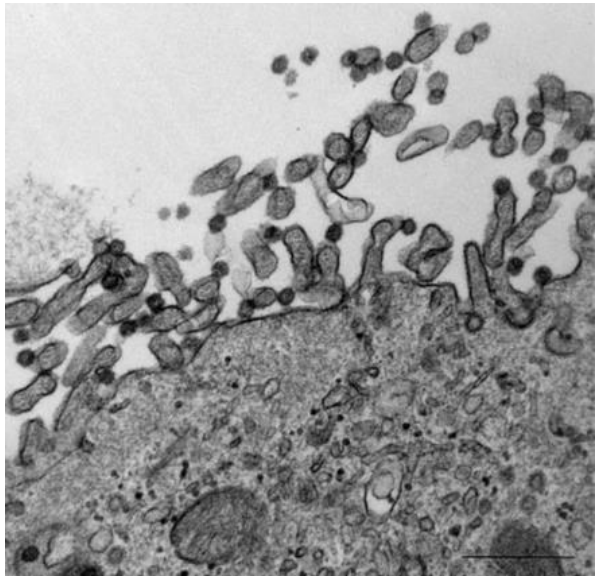
Biology & Microbiology Department

South Dakota State University

Newly isolated in 2011

- Found in respiratory secretions of symptomatic pigs





Hause, B. M., Ducatez, M., Collin, E. A., Ran, Z., Liu, R., Sheng, Z., et al. (2013). PLoS Pathogens, 9(2), e1003176.

→ *Orthomyxoviridae*

What is it?

- rtPCR negative for Influenza A, B and C
- Broad cellular tropism
- Genome sequenced
  - 50% overall homology to human influenza C virus
- Cannot reassort with ICV
- Not recognized by ICV antibodies
  - New virus

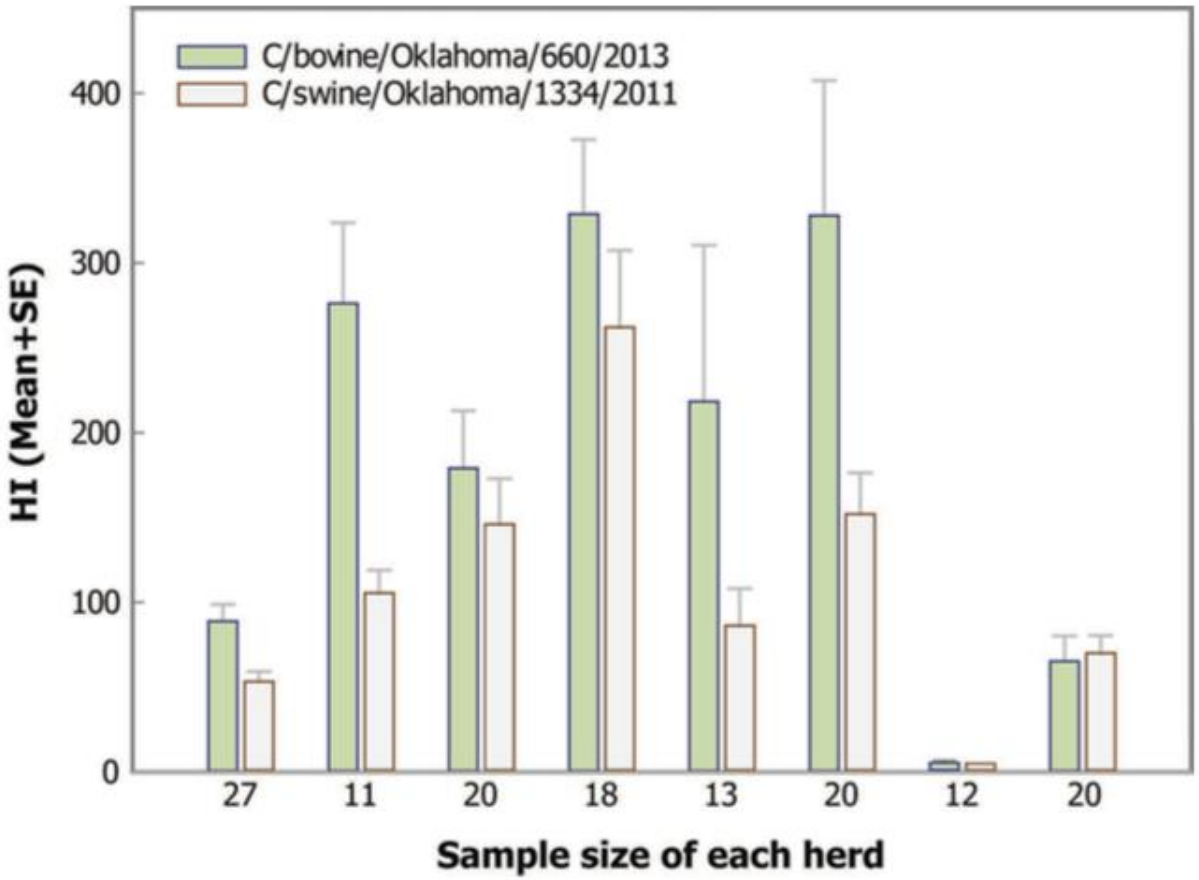
- *Hause, B. M., Ducatez, M., Collin, E. A., Ran, Z., Liu, R., Sheng, Z., et al. (2013). PLoS Pathogens, 9(2), e1003176.*
- *Sheng, Z., Ran, Z., Wang, D., Hoppe, A. D., Simonson, R., Chakravarty, S., et al. (2013) Archives of Virology, 159(2), 249–255.*
- *Hause, B. M., Collin, E. A., Liu, R., Huang, B., Sheng, Z., Lu, W., et al. (2014). mBio, 5(2), e00031–14–e00031–14.*

South Dakota State University
Biology and Microbiology Department

Cattle identified as reservoir

- Influenza D seroprevalence in cattle
  - 88% of dairy herds tested positive for antibodies
  - 18% of nasal swabs from symptomatic animals had detectable RNA by rtPCR
  - Positive cattle herds in Oklahoma, Minnesota, South Dakota, Missouri, Idaho, Vermont, Wisconsin, Illinois, California, Pennsylvania

Seroprevalence in cattle

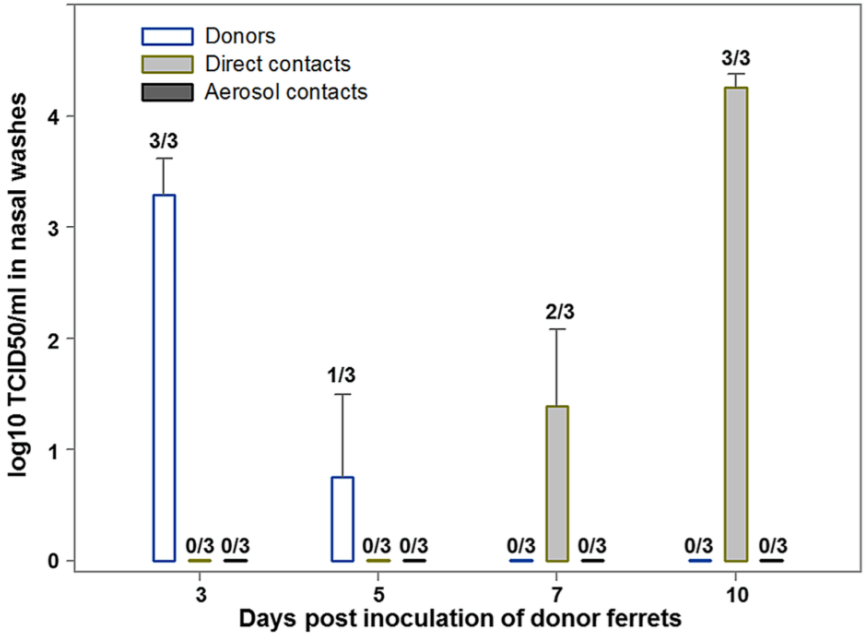


Comparison to other influenza viruses

	FluA	FluB	FluC	FluD
Segments	8	8	7	7
Subtype	17	1	1	1
Host	Multiple	Human	Human	Bovine/ swine
Reservoir	Water fowl/ bird	Human	Human	Bovine
Human Disease	Severe	Severe	Mild	Unclear
Evolution	Fast	Slow	Slow	Unclear

Potential for human infection

- Similar to influenza C
- Infects multiple species
- Animal reservoir
- Infects ferrets



Human Studies

- 1.3% seropositive in human serum samples banked with St. Jude's Children's Research Hospital
  - Elderly individual with uncertain livestock exposure

Cross-sectional study in SD and MN

- Participants recruited in Eastern SD and MN
  - Primarily people with exposure to cattle and pigs
  - People working in vet clinics
  - Community members not exposed to cattle and pigs
- Blood draw
- Questionnaire about animal exposure

Results

- Hemagglutination inhibition (HI) assay on serum samples to detect antibodies
- Serum neutralization on a subset of samples to confirm results
- Low titers 1:40

Participants	Number	Seropositive
Livestock exposed (Farmers or researchers working with the cattle or pigs on a regular basis)	131	0/131
Veterinarians and people working at vet clinics	29	1/29
No cattle or pig contact	50	1/50

Conclusions

- Humans can be infected with Influenza D
- Infection rates are low in livestock exposed and non-exposed people
- Titers are low for those who do have antibodies to virus

Future research

- Identify human receptor
- Impact on livestock operations

Acknowledgements

- Thiex Lab
  - Alyssa Petersen
  - Greg Thompson

- Li Lab
  - Megan Quast
  - Chithra Sreenivasan
  - Milton Thomas

South Dakota State University
Biology and Microbiology Department