

# HPAIV infections in dairy cows

## Experimental results from the FLI

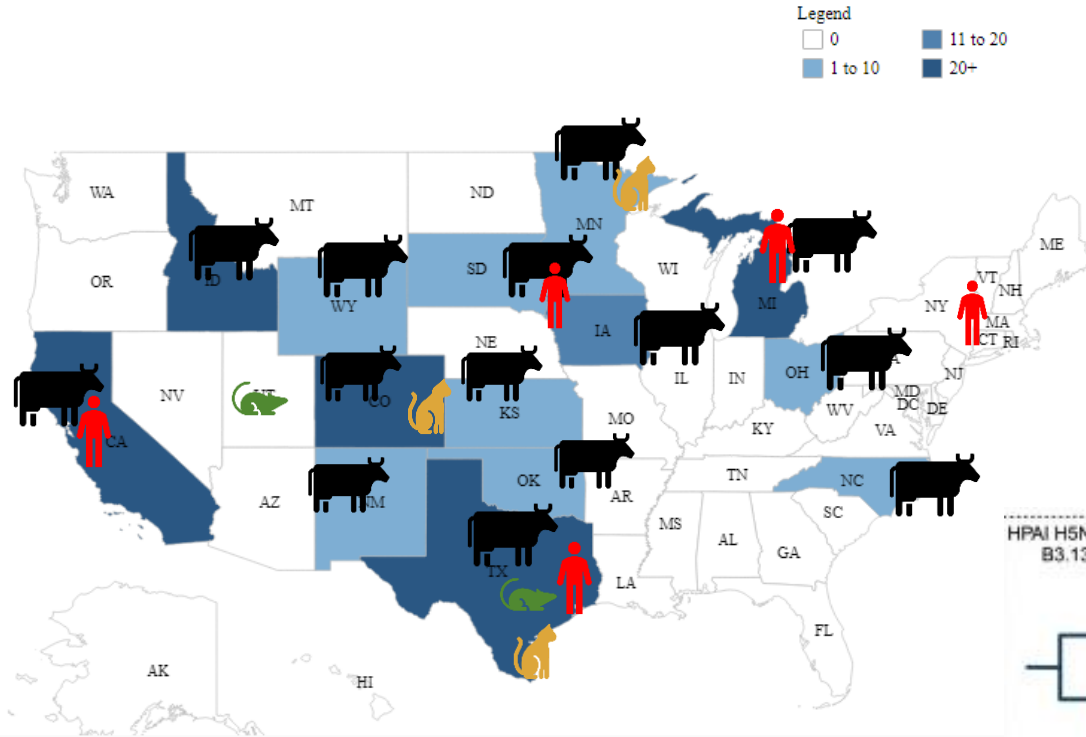


Timm Harder

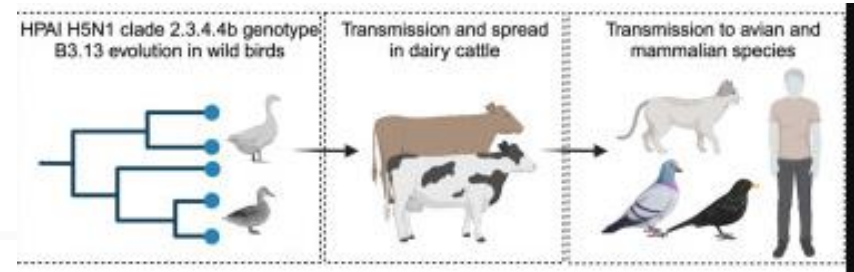
Institute for Diagnostic Virology  
International Reference Laboratory for Animal Influenza  
Friedrich-Loeffler-Institute, Isle of Riems, Germany

EU-RL Annual Meeting,  
2024

# Out of Texas (?): “MooFlu”



- 07.10.2024: 256 farms in 14 federal states
- Few, mild human cases
- Onward transmission to cats and poultry on holdings



<https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/livestock>

Salman et al., 2024 <https://doi.org/10.3168/jdsc.2024-0638>

# “MooFlu”: How did it start in first place?



<https://www.aphis.usda.gov/livestock-poultry-disease/avian-influenza/hpai-detections/livestock>



[https://www.researchgate.net/publication/316841755\\_Clinical\\_observations\\_on\\_some\\_surgical\\_udder\\_and\\_teat\\_affectious\\_in\\_cattle\\_and\\_buffaloes/figures](https://www.researchgate.net/publication/316841755_Clinical_observations_on_some_surgical_udder_and_teat_affectious_in_cattle_and_buffaloes/figures)

- „The udder looks like a normal chicken to the virus.“
- Virus must have entered the udder of the index cow directly
  - Penetrating teat injury, virus present in bedding?
- Extremely rare instance? Virus and lactating ruminants (e.g. water buffaloes) have shared the same environment for decades; no reports from other regions
- Have specific U.S. dairy farming conditions played a fostering role in establishing spread?

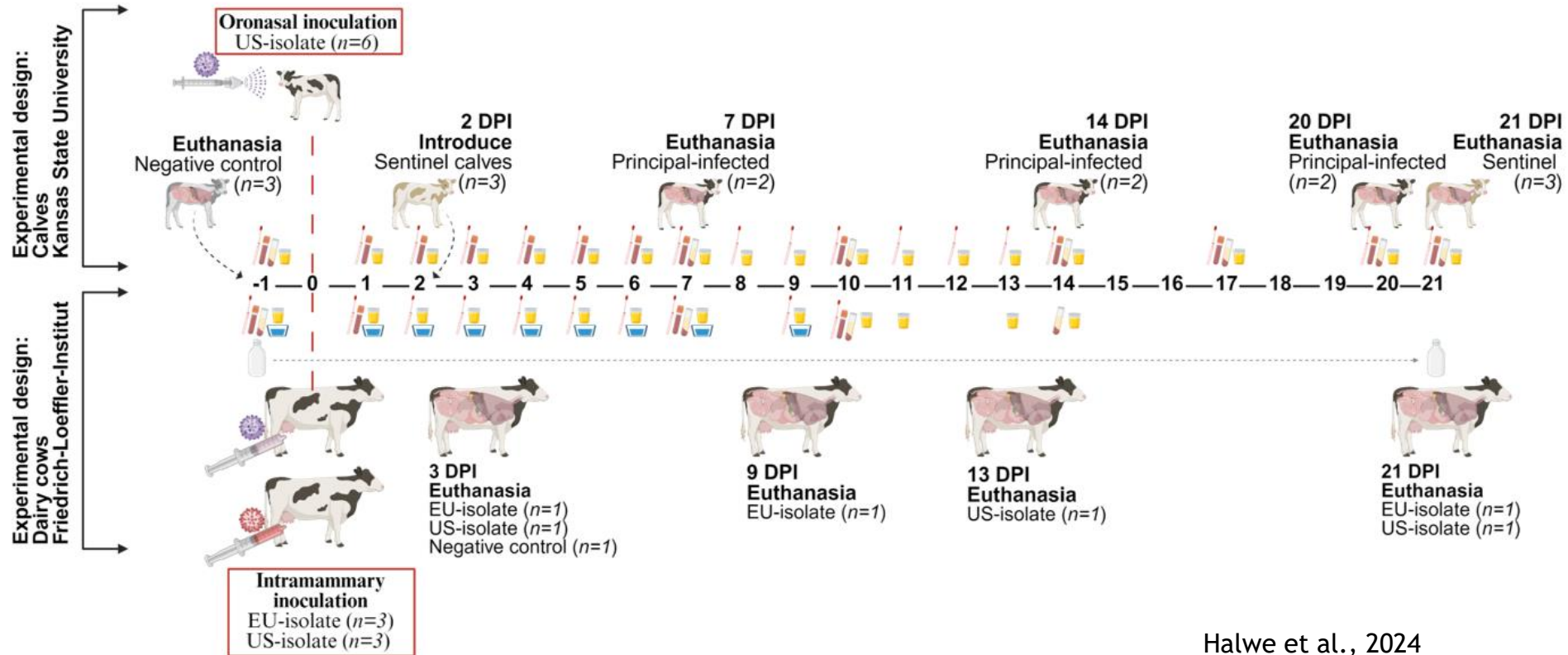
# Laboratory: Labor plus Oratory

**The FLI dairy cow team:**  
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Björn Corleis,  
Lorenz Ulrich,  
Donata Hoffmann,  
Martin Beer



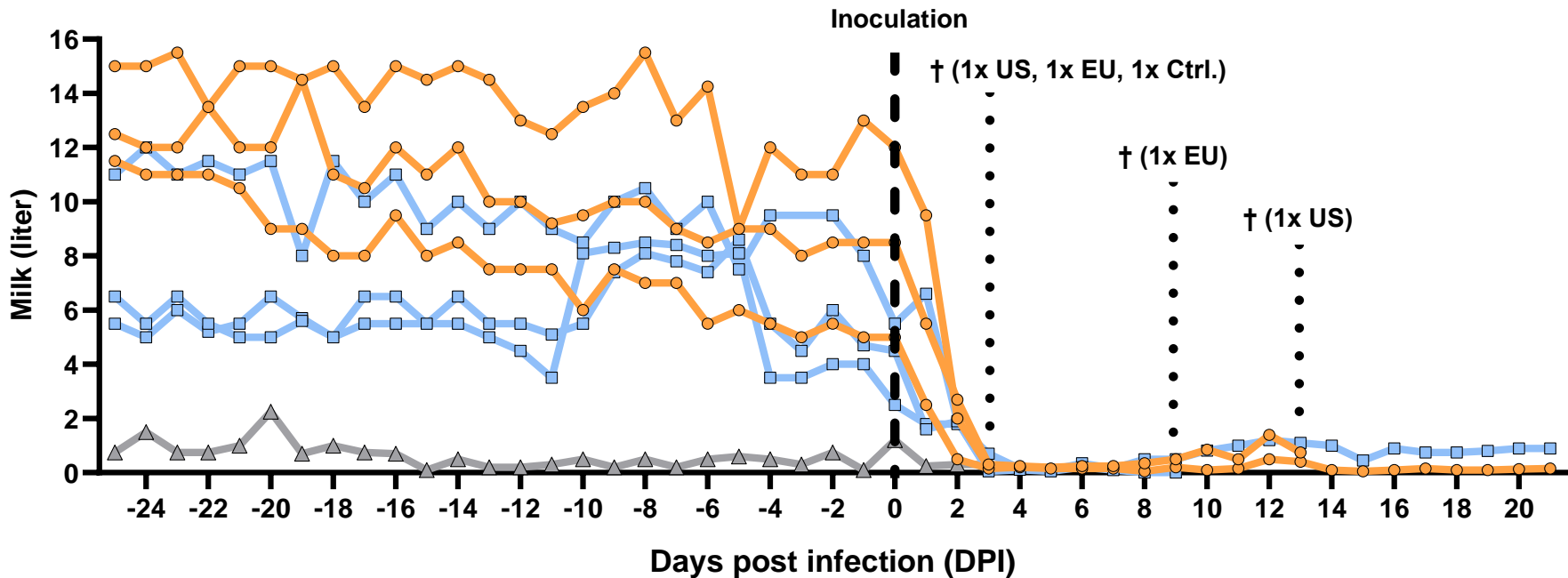


# FLI study: The experimental setting



Halwe et al., 2024

# US and European HPAIV H5N1 cause mastitis in dairy cows



Cows

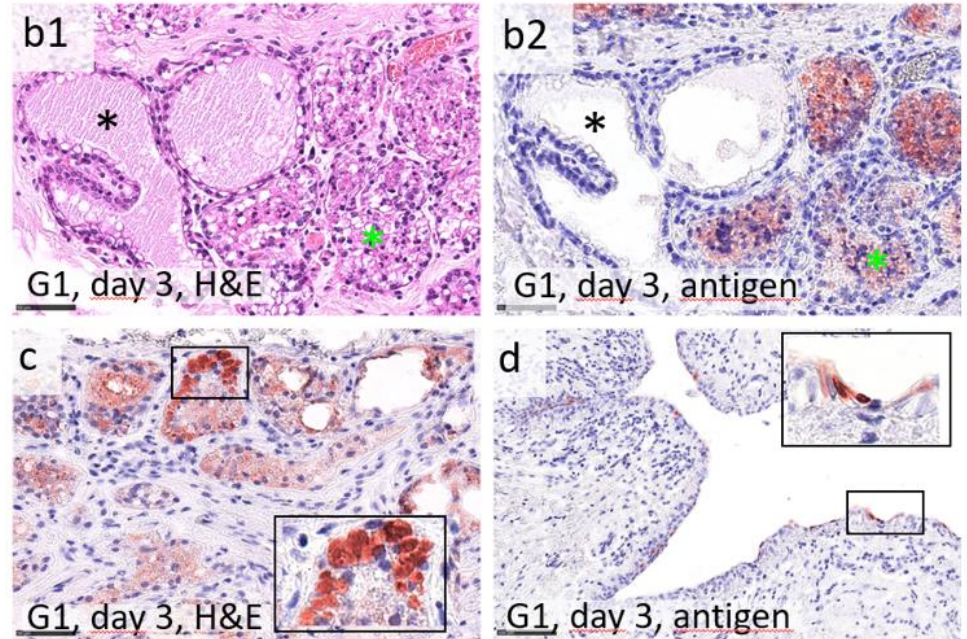
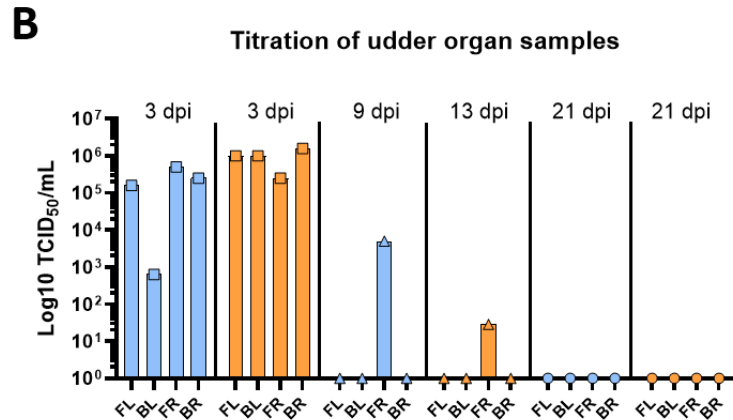
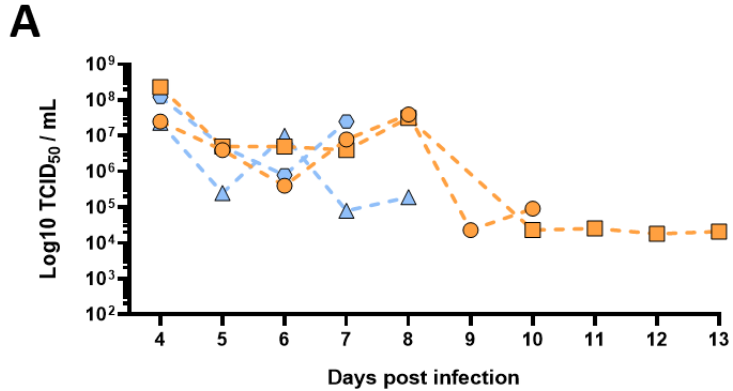


Calves



Halwe, N.J., Cool, K., Breithaupt, A. *et al.* H5N1 clade 2.3.4.4b dynamics in experimentally infected calves and cows. *Nature* (2024). <https://doi.org/10.1038/s41586-024-08063-y>

# High viral loads in milk and udder tissues



Halwe et al., 2024

# The serological response

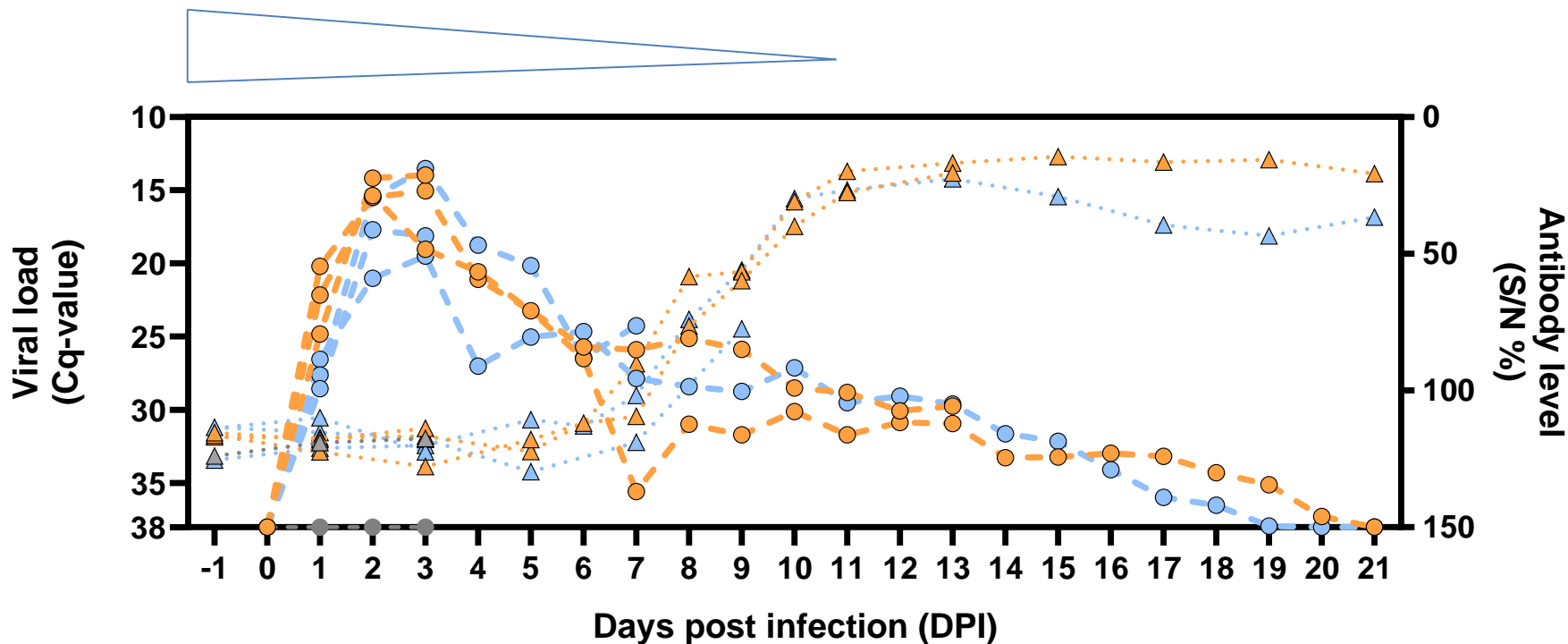
Cow ID		DPC						
		0	3	7	9	13	14	21
lactating cows	NP-cELISA	-		+			+	+
	H5-cELISA	-		-			+	+
	VNT <sub>100</sub> (Serum vs US-isolate)	<1:16		<1:16			406	322
	VNT <sub>100</sub> (Serum vs EU-isolate)							
US-isolate	NP-cELISA	-		+		+		
	H5-cELISA	-		-		+		
	VNT <sub>100</sub> (Serum vs US-isolate)	<1:16		N/A		812		
	VNT <sub>100</sub> (Serum vs EU-isolate)							
lactating cows	NP-cELISA	-	-					
	H5-cELISA	-	-					
	VNT <sub>100</sub> (Serum vs US-isolate)	<1:16	<1:16					
	VNT <sub>100</sub> (Serum vs EU-isolate)							
lactating cows	NP-cELISA	-		+			+	+
	H5-cELISA	-		-			+	+
	VNT <sub>100</sub> (Serum vs US-isolate)	<1:16		<1:16			406	256
	VNT <sub>100</sub> (Serum vs EU-isolate)							
EU-isolate	NP-cELISA	-		-	+			
	H5-cELISA	-		-	+			
	VNT <sub>100</sub> (Serum vs US-isolate)	<1:16		<1:16	<1:16			
	VNT <sub>100</sub> (Serum vs EU-isolate)							
EU-isolate	NP-cELISA	-	-					
	H5-cELISA	-	-					
	VNT <sub>100</sub> (Serum vs US-isolate)	<1:16	<1:16					
	VNT <sub>100</sub> (Serum vs EU-isolate)							

- NP ELISA positive from day 7 onwards
- H5-ELISA less sensitive
- High neutralizing antibody titres from week 2 onwards

Halwe et al., 2024

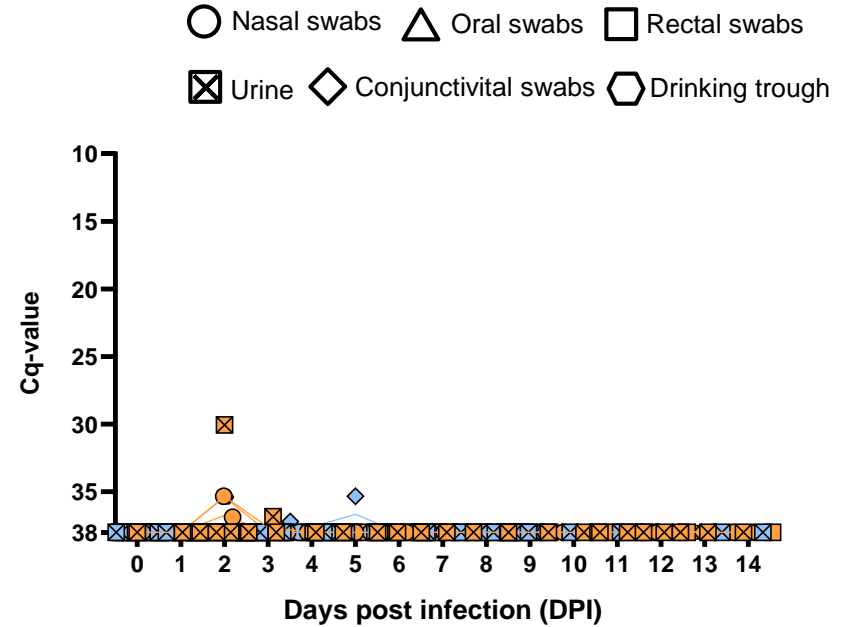
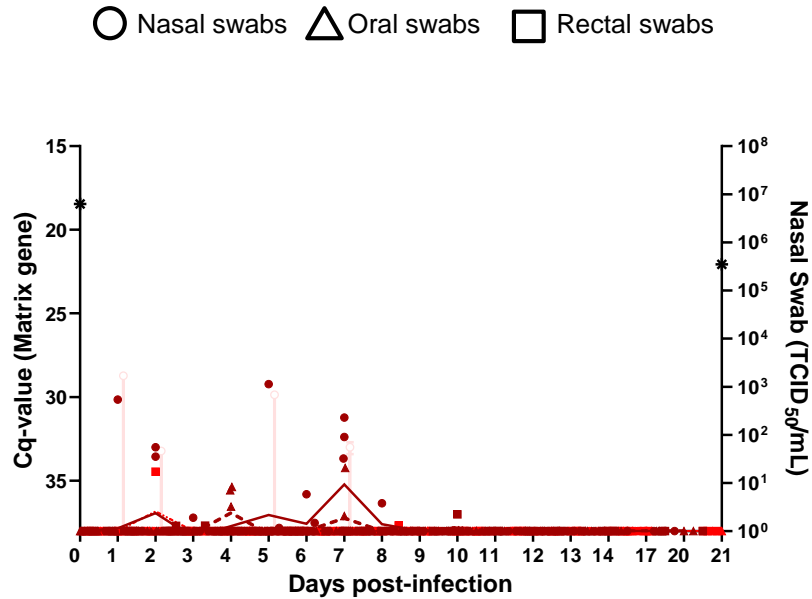


# Antibodies neutralize high HPAIV H5N1 loads in milk



Halwe, N.J., Cool, K., Breithaupt, A. *et al.* H5N1 clade 2.3.4.4b dynamics in experimentally infected calves and cows. *Nature* (2024). <https://doi.org/10.1038/s41586-024-08063-y>

# Negligible virus detection outside the udder



**Calves**

■ US-isolate calves (Principal-infected)	■ US-isolate calves (Sentinel)
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**Cows**

■ US-isolate	■ EU-isolate	■ Ctrl.
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Halwe, N.J., Cool, K., Breithaupt, A. *et al.* H5N1 clade 2.3.4.4b dynamics in experimentally infected calves and cows. *Nature* (2024). <https://doi.org/10.1038/s41586-024-08063-y>

# No evidence for MooFlu in Germany (spring 2024)



- Representative sampling excluding 0.2% prevalence in dairy herds in Germany
- Bulk milk of 1084 holdings examined by RT-qPCR with negative results at FLI
- Holdings in Bavaria (ca. 700 additional) with negative results examined by Bavarian State lab services
- Ca. 1.500 bovine serum samples from dairy farms with grazing cows near the Germany coasts examined with negative serological results at the FLI (Chr. Grund)

# “MooFlu” in the US: Missed roads to prevention?

## U.S. government in hot seat for cow flu outbreak response

Veterinarians and researchers say it has taken too long to share data on viral changes, spread, and milk safety

J. Cohen, Science **370** 26 APRIL 2024 • VOL 384 ISSUE 6694



- A “simple” task at the beginning: test (tank milk), block (positive farms), discard (milk from these farms), but
  - No general access of veterinary authorities to dairy farms
  - No unified restriction orders in the beginning
  - Only interstate transport of dairy cattle prohibited w/o testing.
- Now a much more difficult and expensive task (compromised credibility of dairy farmers and public vet system)
- Vaccination of dairy cattle not a straight forward option



Thank you, questions?



Photo © A. Globig, FLI