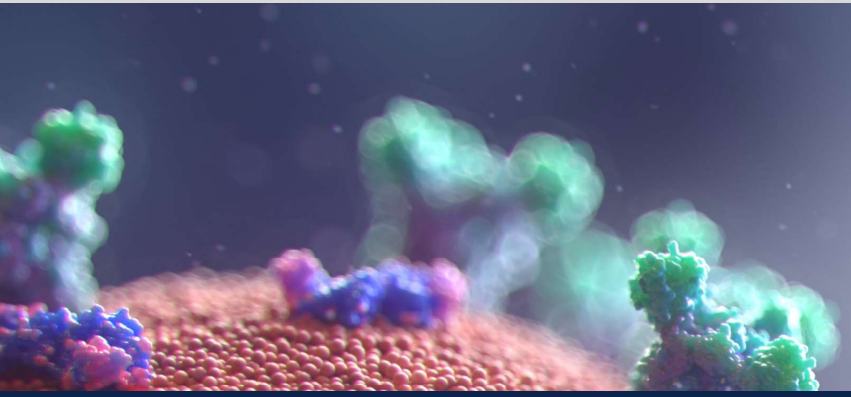
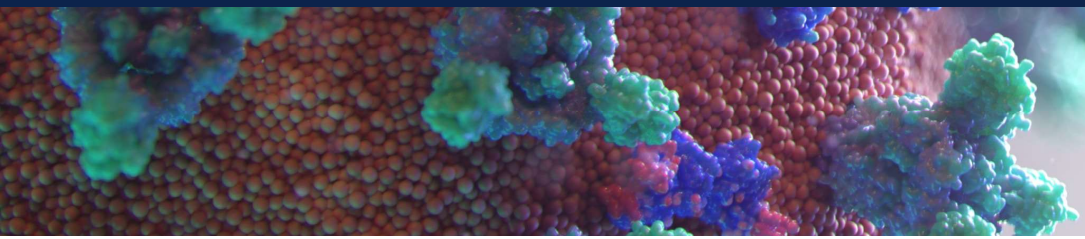


THE UNIVERSITY OF ARIZONA

Genomic epidemiology of avian and bovine H5N1 influenza

Michael Worobey
Department of Ecology and Evolutionary Biology,
University of Arizona

March 18th, 2025
WHO R&D Blueprint's virtual global consultation on **What research is important to prepare and respond to H5N1 influenza outbreaks?**



CEIRR
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Reports of nonspecific illness in February 2024

- Reduced feed intake and rumination
- Abrupt drop in milk production
- ~10-15% ill dairy cattle, minimal mortality
- … in March 2024, cats fed raw colostrum and milk resulted in neurologic signs (and some mortality), dead birds on premises

Burrough et al. (2024) EID

Iowa State VDL; TAMU VMDL

NEWS

Eyes are focused on an illness affecting milk output in dairy cows in the Texas panhandle

Lee Mielke Farmers' Advance

Published 11:40 a.m. ET March 25, 2024 | **Updated 4:02 p.m. ET March 25, 2024**

U.S. milk production remained below a year ago in February, the eighth consecutive month to do so, thanks to lower cow numbers and output per cow.

Photo: Baker et al. (in press)

HEALTH

This Texas veterinarian helped crack the mystery of bird flu in cows

Photo provided by Sunrise Veterinary Service in May 2024 shows Barbara Petersen. The first calls the Amarillo veterinarian received in early March

BY JONEL ALECCIA

Updated 2:42 PM MST, May 1, 2024

Share

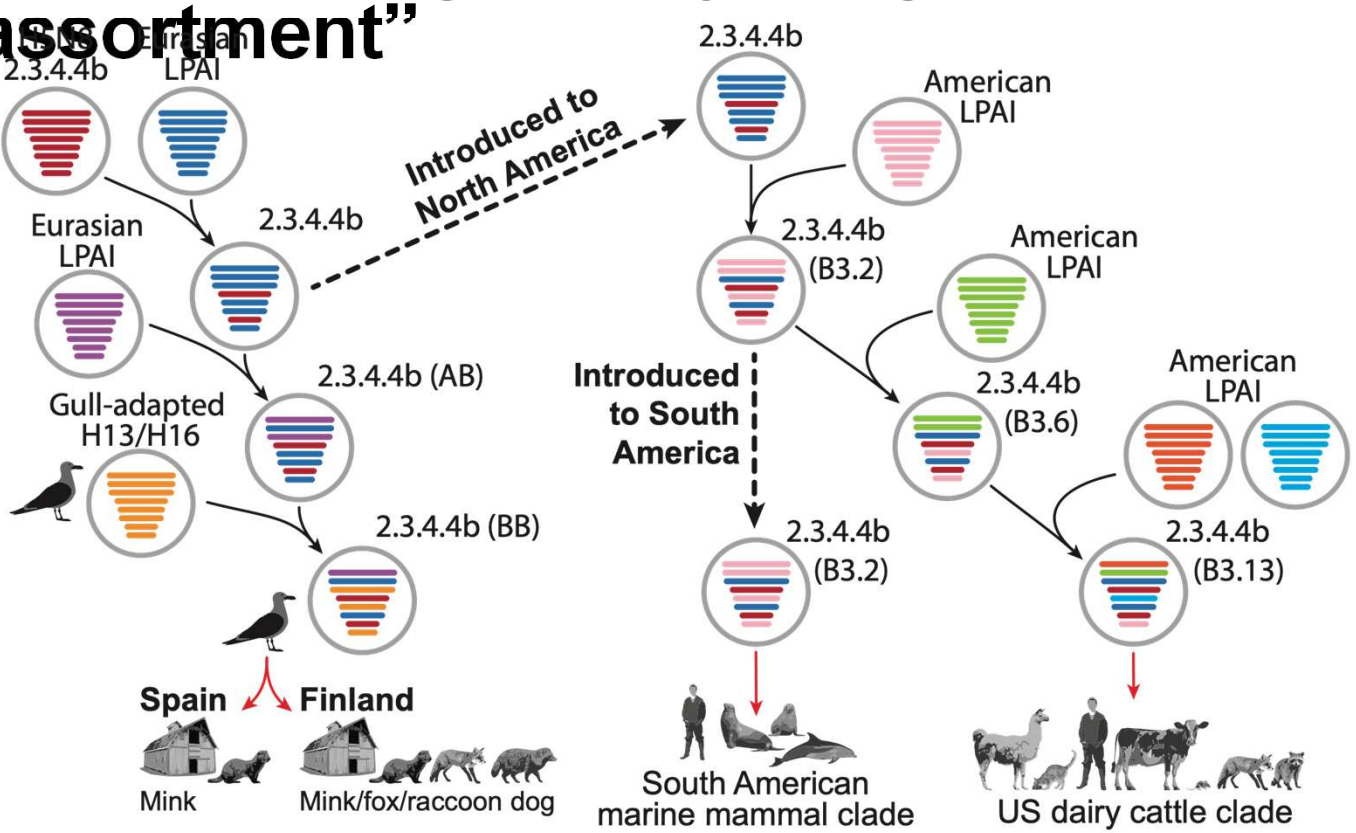
The first calls that Dr. Barb Petersen received in early March were from dairy owners worried about crows, pigeons and other birds dying on their Texas farms. Then came word that barn cats — half of them on one farm — had died suddenly.

Within days, the Amarillo veterinarian was hearing about sick cows with unusual symptoms: high fevers, reluctance to eat and much less milk. Tests for typical illnesses came back negative.

Petersen, who monitors more than 40,000 cattle on a dozen farms in the Texas Panhandle, collected samples from cats and cows and sent them to Dr. Drew Magstadt, a friend from college who now works at the veterinary diagnostic laboratory at Iowa State University.

The samples tested positive for a bird flu virus never before seen in cattle. It was the first proof that the bird flu, known as Type A H5N1, could infect cows. As of Wednesday, 36 U.S. herds had confirmed infections, according to the U.S. Agriculture Department.

H5N1 is evolving rapidly via genomic "reassortment"



Peacock et al., 2024 *Nature*

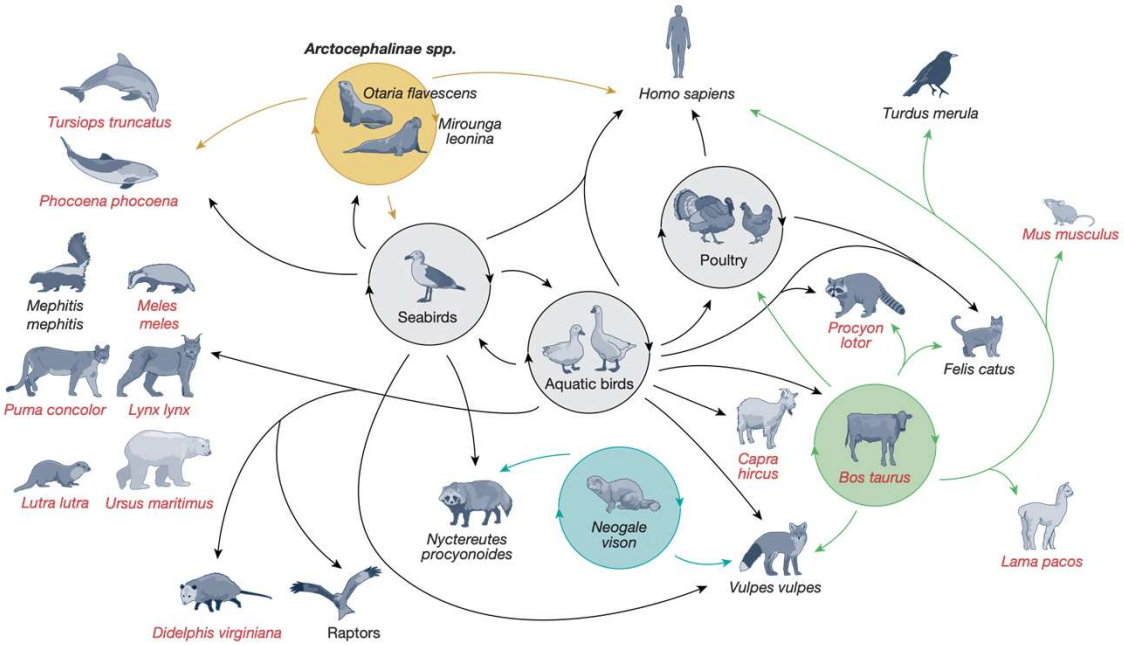
Perspective | Published: 24 September 2024

The global H5N1 influenza panzootic in mammals

Thomas P. Peacock, Louise Moncla, Gytis Dudas, David VanInsberghe, Ksenia Sukhova, James O. Lloyd-Smith, Michael Worobey, Anice C. Lowen & Martha I. Nelson

H5N1 is expanding its host range

Especially in mammals



Peacock et al., 2024 *Nature*

Genetically adapting to mammals

Otaria flavescens

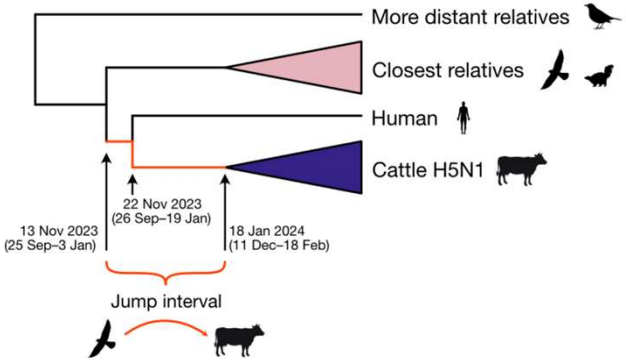
H5N1, South American marine mammals
Q591K and D701N

Neovison vison

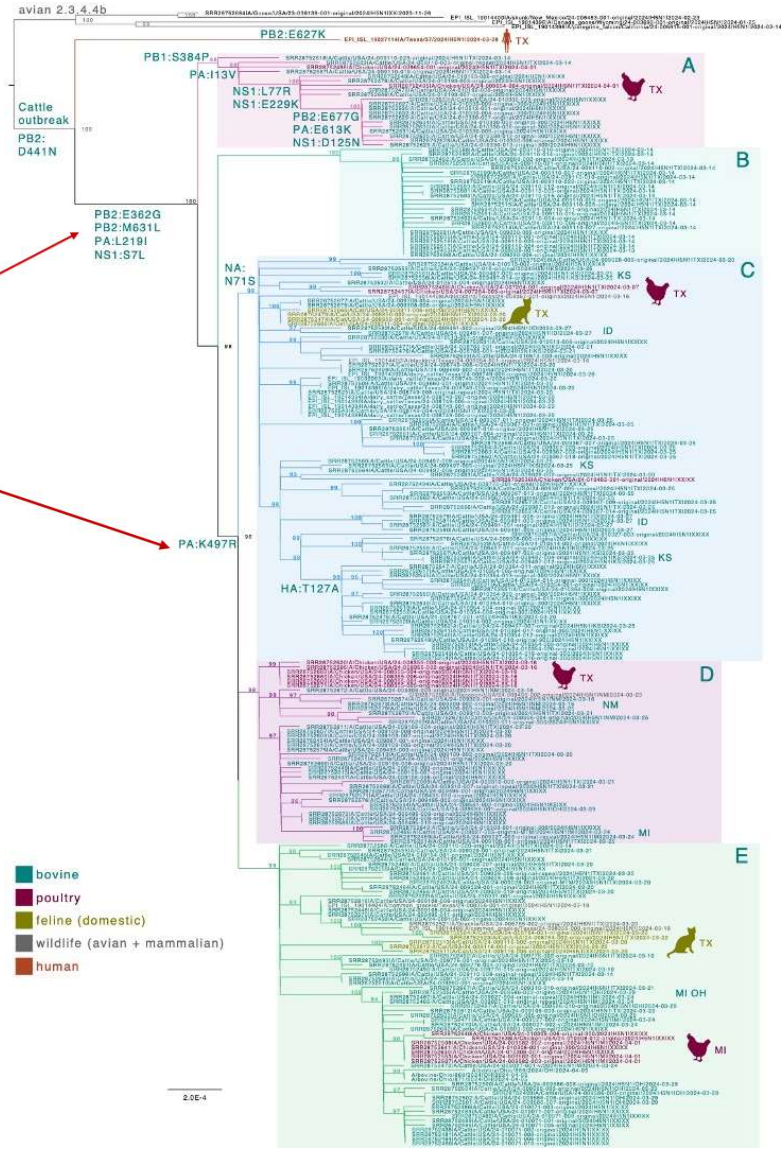
H5N1, mink farms in Europe
E627K

H5N1, US dairy cattle
M631L

B3.13 spillover to dairy cattle



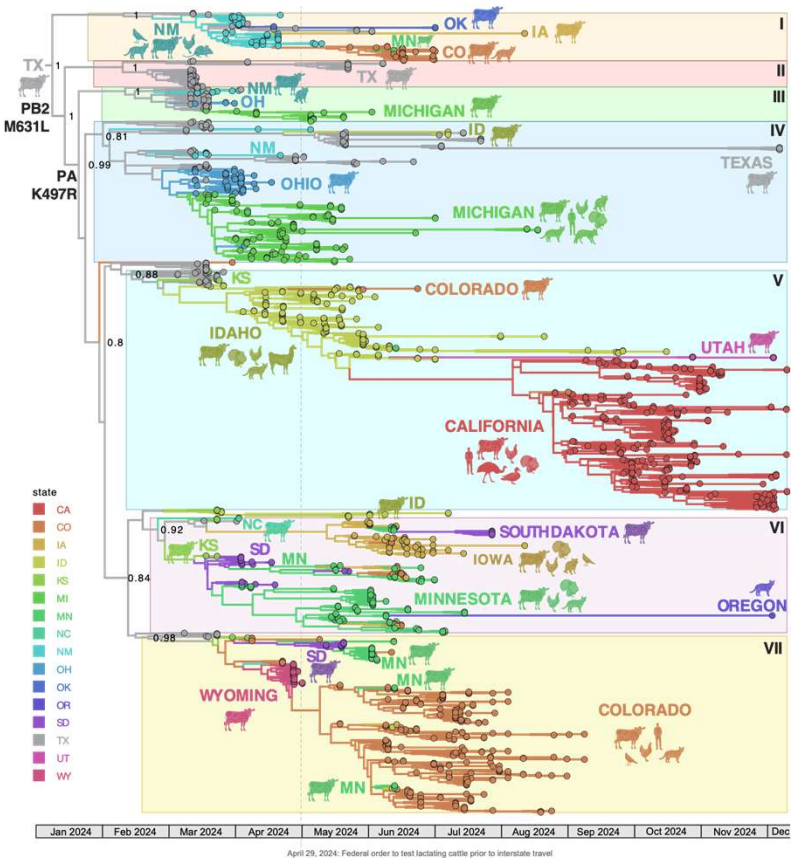
Mammalian adaptations



Worobey et al., 2024

H5N1 (B3.13) spatial spread in US dairy cattle

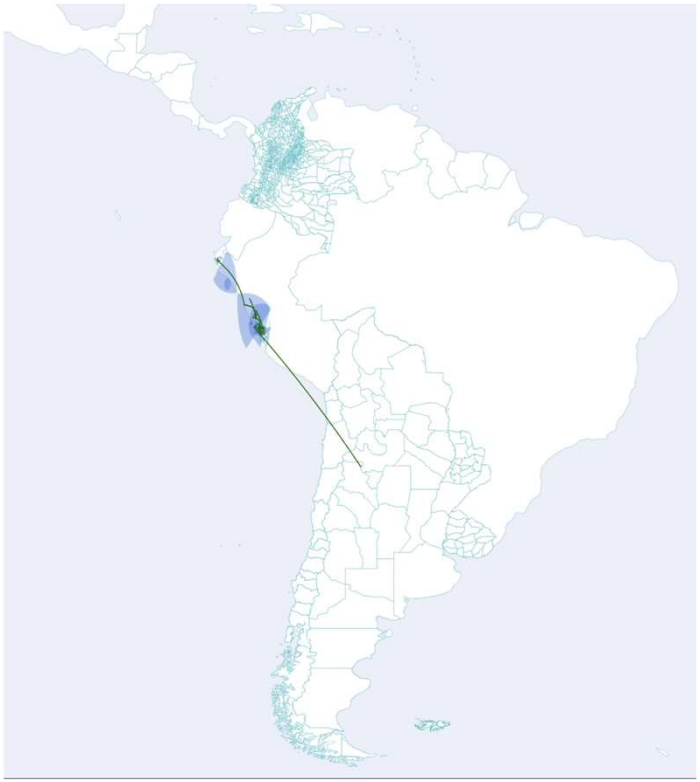
- Genomic data can finely resolve pathways of disease transmission



Unpublished

B3.2 spatial spread in South America

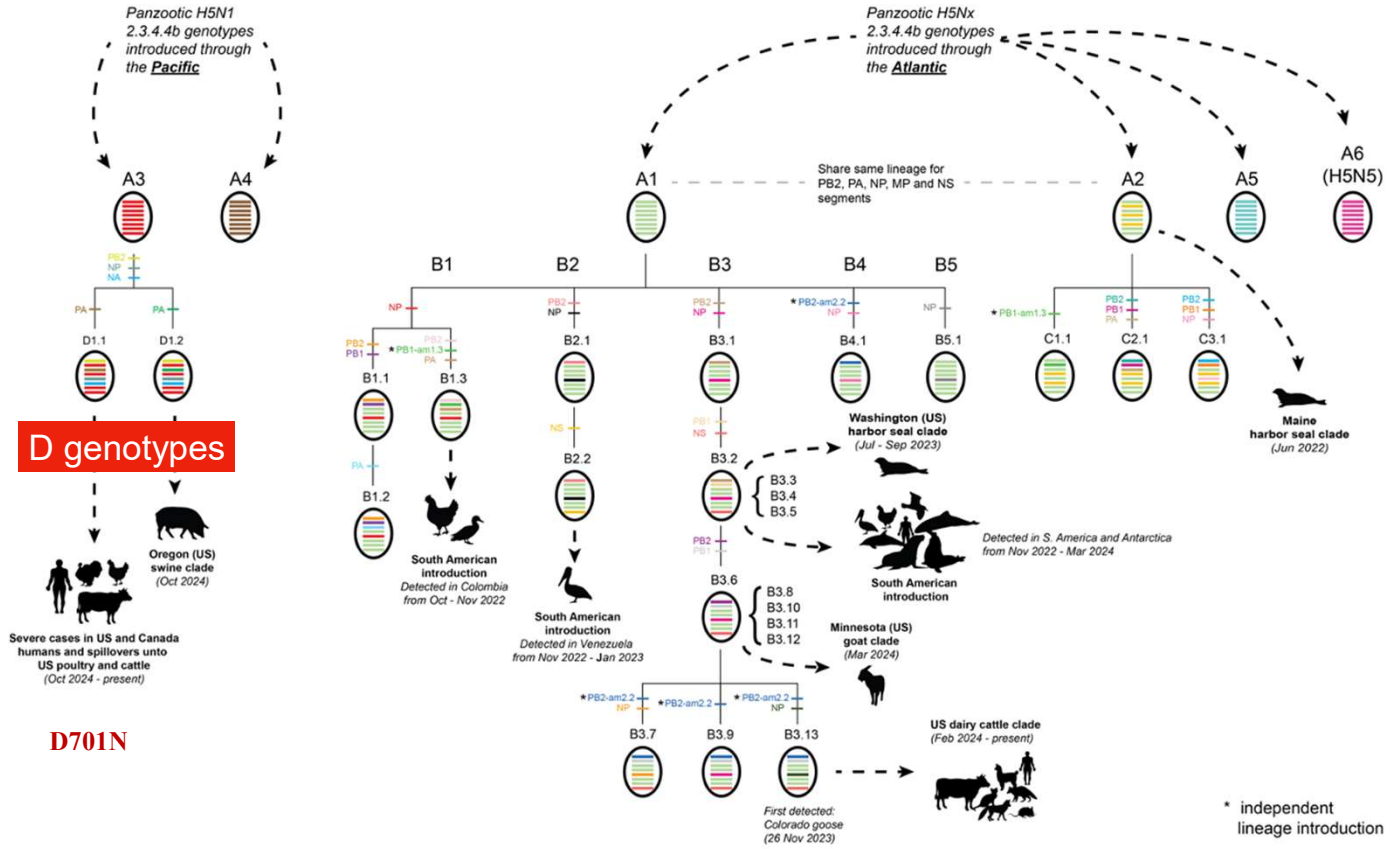
Spatial dissemination in migrating birds



Mammal-adapted marine mammal clade

Unpublished

New genotypes (D1) emerging in North America

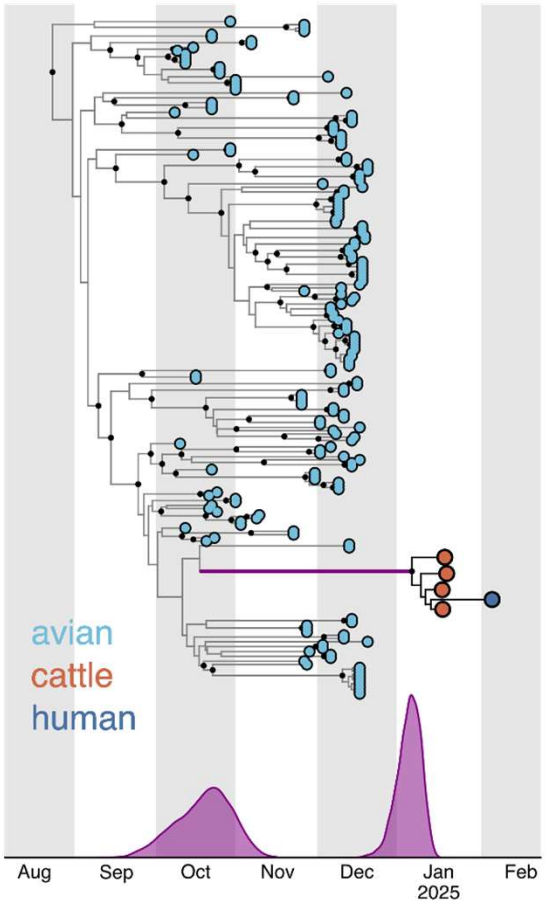


Unpublished

When did D1.1 likely spillover into cattle?

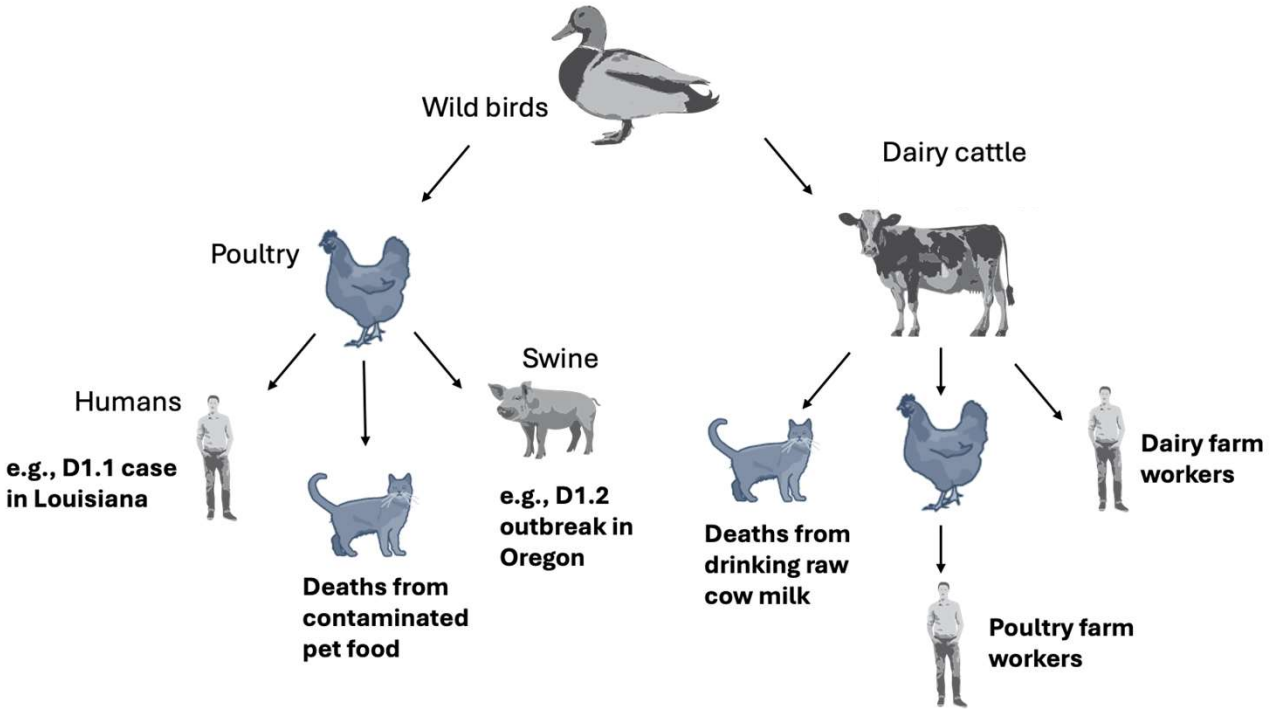
As of 15 February:
4 cattle viruses
1 human virus

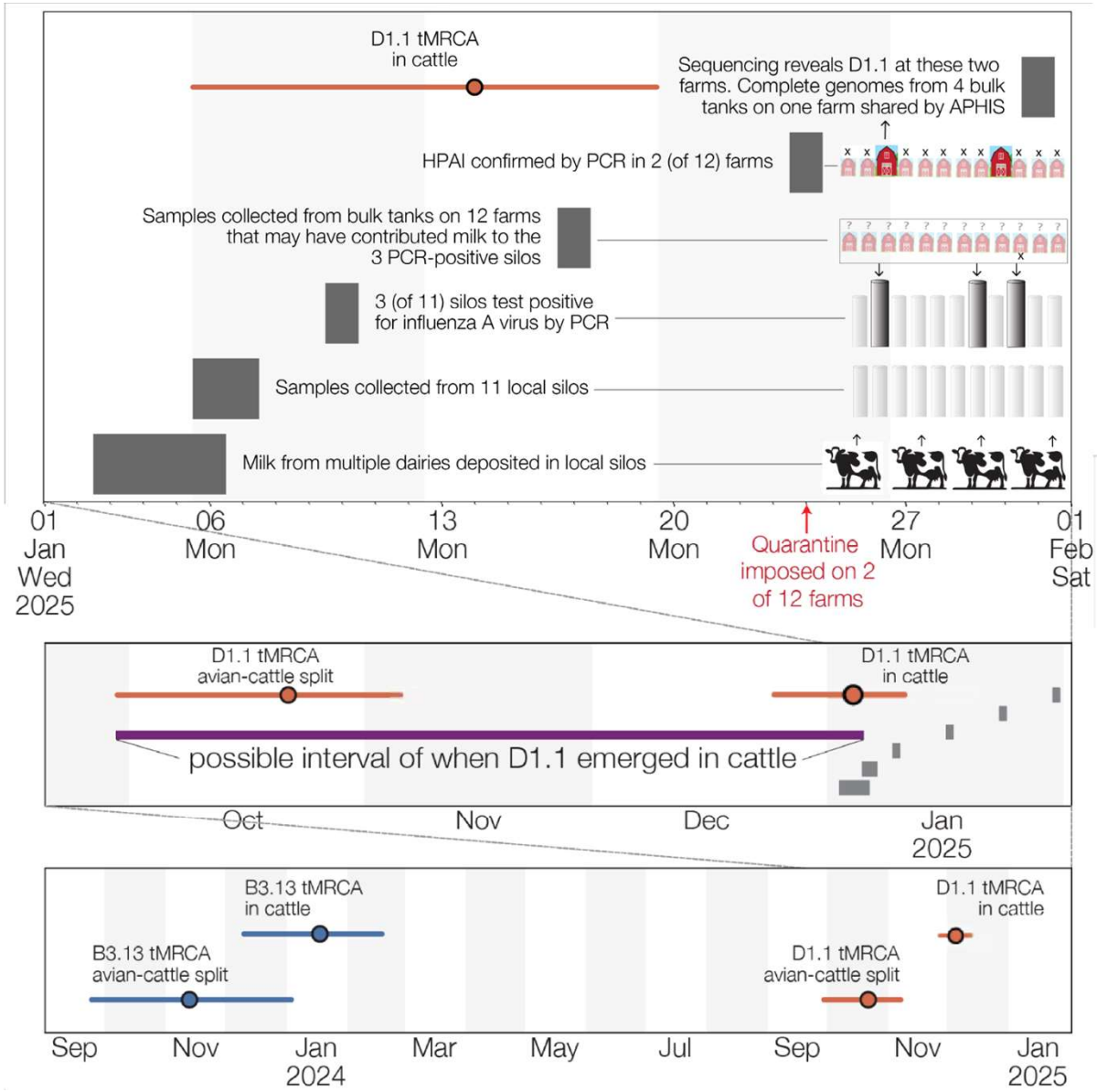
Spillover likely between Oct. and Jan.



Credit: Jonathan Pekar

Multiple pathways to H5N1 spillover





Timing and molecular characterisation of the transmission to cattle of H5N1 influenza A virus genotype D1.1, clade 2.3.4.4b

Influenza virus · H5N1-global

W **worobey** 4 25d

Jonathan E. Pekar, Institute of Ecology and Evolution, University of Edinburgh, Edinburgh, UK

Feb 21

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Feb 21

What research is important to prepare and respond to H5N1 influenza outbreaks?

- **H5N1 is rapidly evolving in the Americas**
  - Vigilant surveillance of wild bird and mammal population
  - Real-time monitoring of dairy cattle and other domestic animals
  - Sensitive, rapid diagnostics easy to deploy in the field
- **Spillover risk is increasing**
  - Effective detection of spillovers into US dairy cattle, and cattle outside US
  - Effective detection of spillovers to humans from cattle, birds, or other species
  - Development of tests for H5 viruses in humans: antigen, nucleic acids, antibodies

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