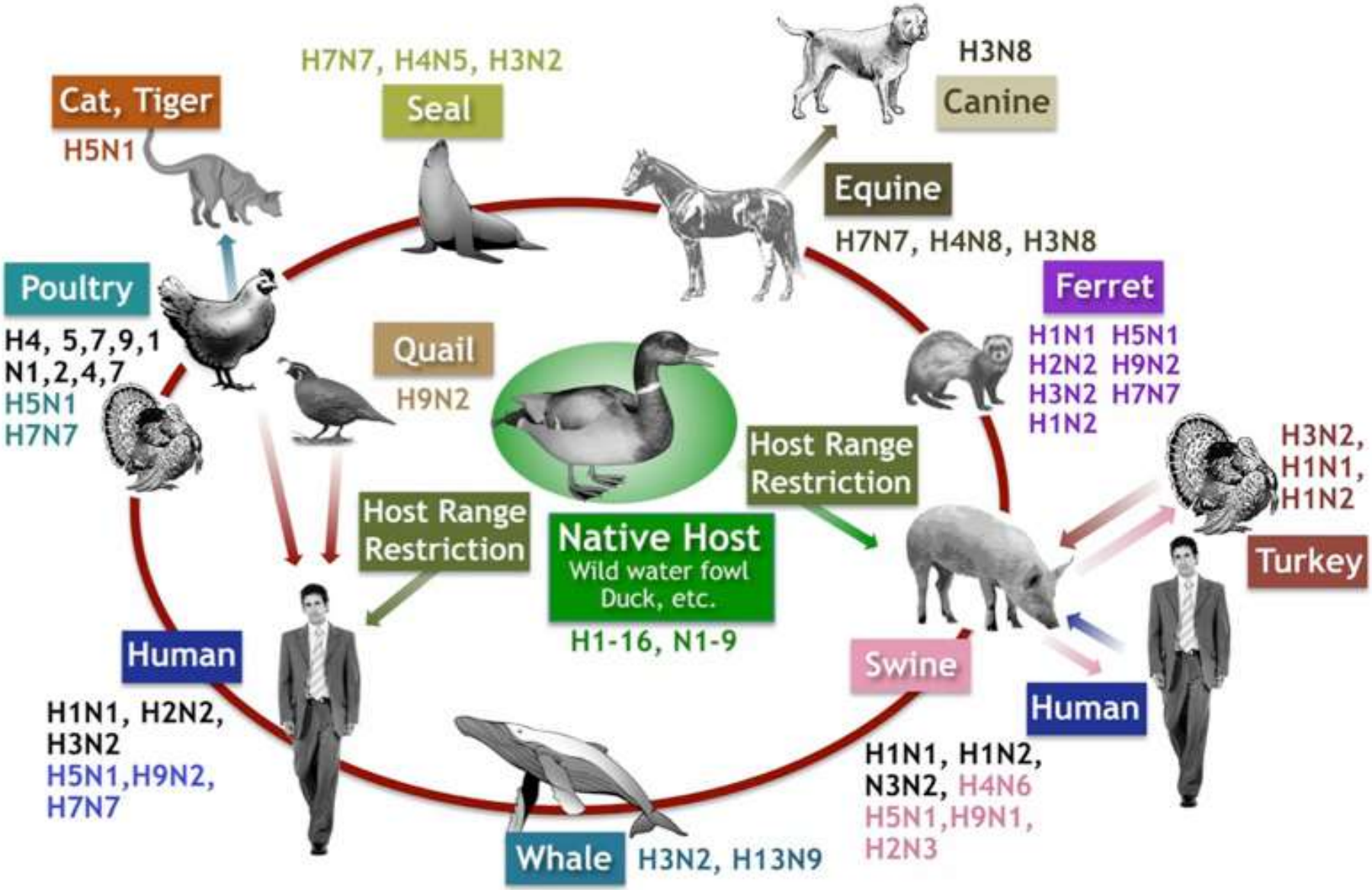
Highly Pathogenic Avian Influenza 2022

Krysten Schuler & Diego Diel


Cat, Tiger
H5N1
H7N7, H4N5, H3N2
Seal
H3N8
Canine
Equine
H7N7, H4N8, H3N8
Poultry
H4, 5,7,9,1
N1,2,4,7
H5N1
H7N7
Quail
H9N2
Ferret
H1N1 H5N1
H2N2 H9N2
H3N2 H7N7
H1N2
Host Range
Restriction
Native Host
Wild water fowl
Duck, etc.
H1-16, N1-9
Host Range
Restriction
H3N2,
H1N1,
H1N2
Turkey
Human
H1N1, H2N2,
H3N2
H5N1,H9N2,
H7N7
Swine
H1N1, H1N2,
N3N2, H4N6
H5N1,H9N1,
H2N3
Human
Whale
H3N2, H13N9

Avian Influenza in Wild Birds

- Waterbirds (ducks, gulls, shorebirds) are natural reservoirs
- All 16 H and 9 N combinations occur
- AI endemic to waterbirds (low path)
- Subclinical/mild disease respiratory/GI tract
- Fecal-oral transmission
- Raptors/scavengers may be infected by ingestion
- Wildlife migrations can cause virus mixing

AI and Migration

- Bird Migration is means of spread
- Flyways = main migration routes
- Some crossover between routes
- Birds mix in breeding grounds in North and Wintering grounds in South
- Directionality:

North: March to May

South: August to November

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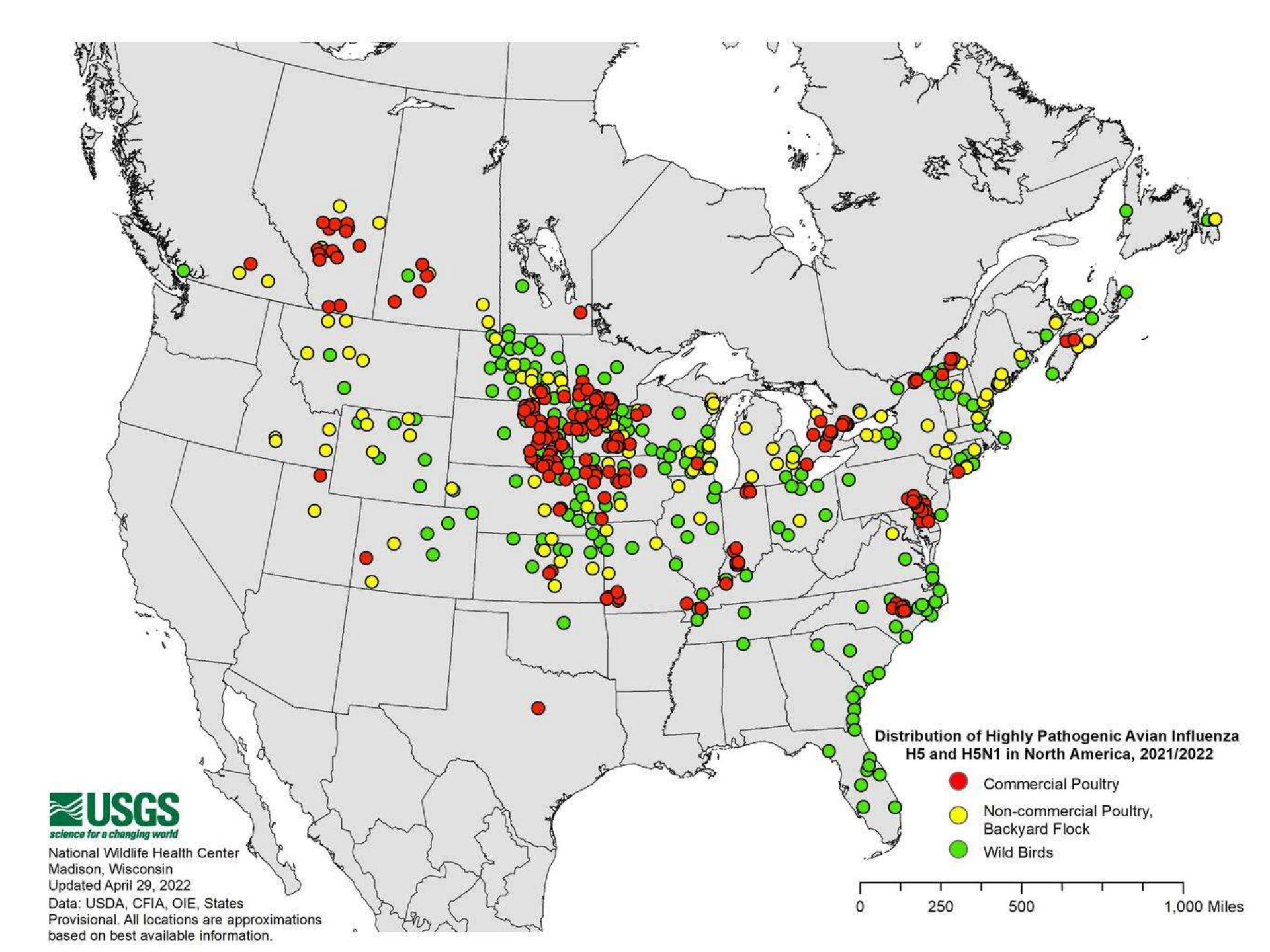
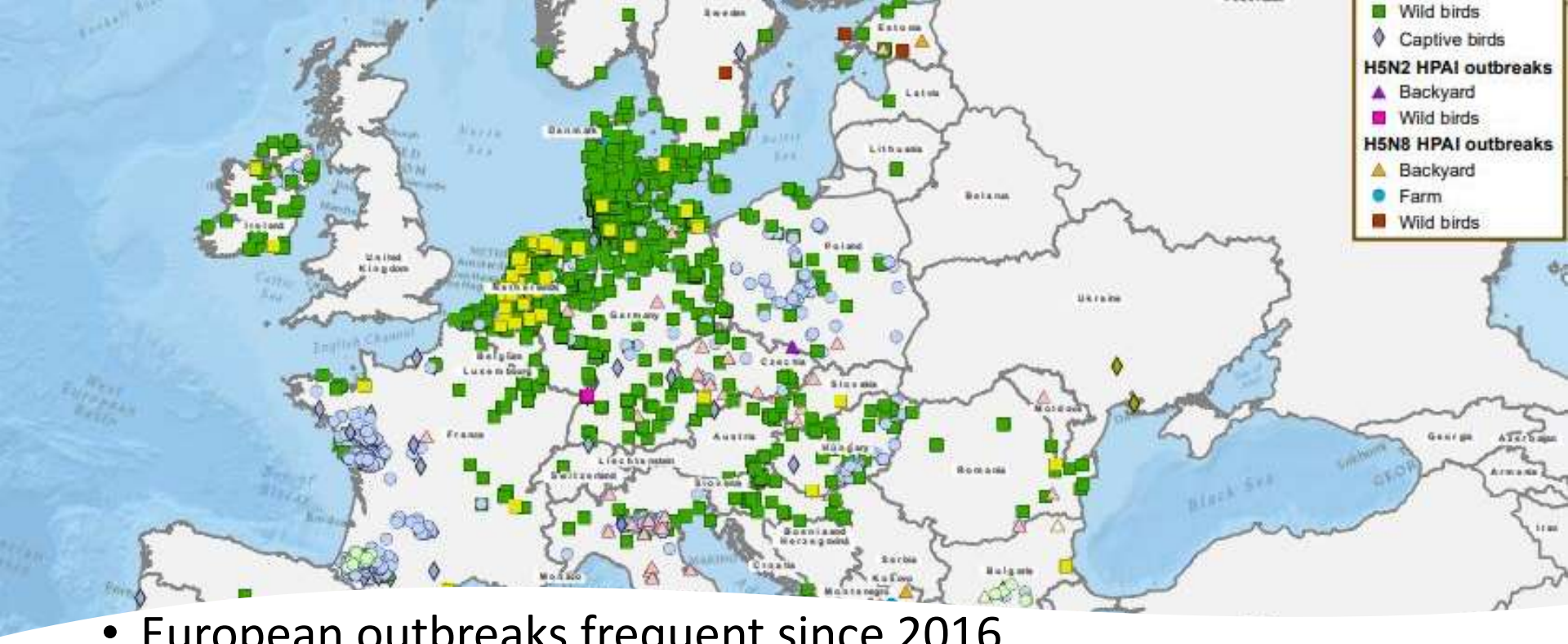
The analysis of band recovery data enabled waterfowl biologists to delineate North America's four waterfowl flyways.


Distribution of Highly Pathogenic Avian Influenza
H5 and H5N1 in North America, 2021/2022
Commercial Poultry
Non-commercial Poultry,
Backyard Flock
Wild Birds
0
250
500
1,000 Miles
USGS
science for a changing world
National Wildlife Health Center
Madison, Wisconsin
Updated April 29, 2022
Data: USDA, CFIA, OIE, States
Provisional. All locations are approximations
based on best available information.



- European outbreaks frequent since 2016
- Changing Strains with different impacts
- This same H5NI circulating since October 2021
    - 36 countries, 867 outbreaks
- Many species affected- including geese, raptors, cranes, and some mammals (fox and otters)
- Annual spread east to west with fall migration of wild birds

AI: NY Wild Birds

- Suffolk County: waterfowl, shorebirds
- Wayne/Cayuga County: Montezuma Wildlife Refuge 150 Snow Geese
- Seneca County: Snowy Owls
- Additional Species: Cooper’s Hawk, Great Blue Heron, Canada Geese, Mallard, Swans, Sanderling, Wild turkey Vultures, Bald eagles, Fish crow
- Assume its widespread

Avian Influenza

Cornell University
College of Veterinary Medicine
Animal Health Diagnostic Center

BASICS

Avian influenza (AI) viruses occur naturally among wild aquatic birds worldwide and can infect domestic poultry and other bird and animal species. **WILD AQUATIC BIRDS** can be infected with avian influenza A viruses in their intestines and respiratory tract, but usually do not get sick.

AI viruses are classified as either low pathogenic avian influenza **(LPAI)**, or high pathogenic avian influenza **(HPAI)** according to the virus strain's impact on domestic poultry.

CLINICAL SIGNS for viruses are markedly different from LP to HP AI viruses.

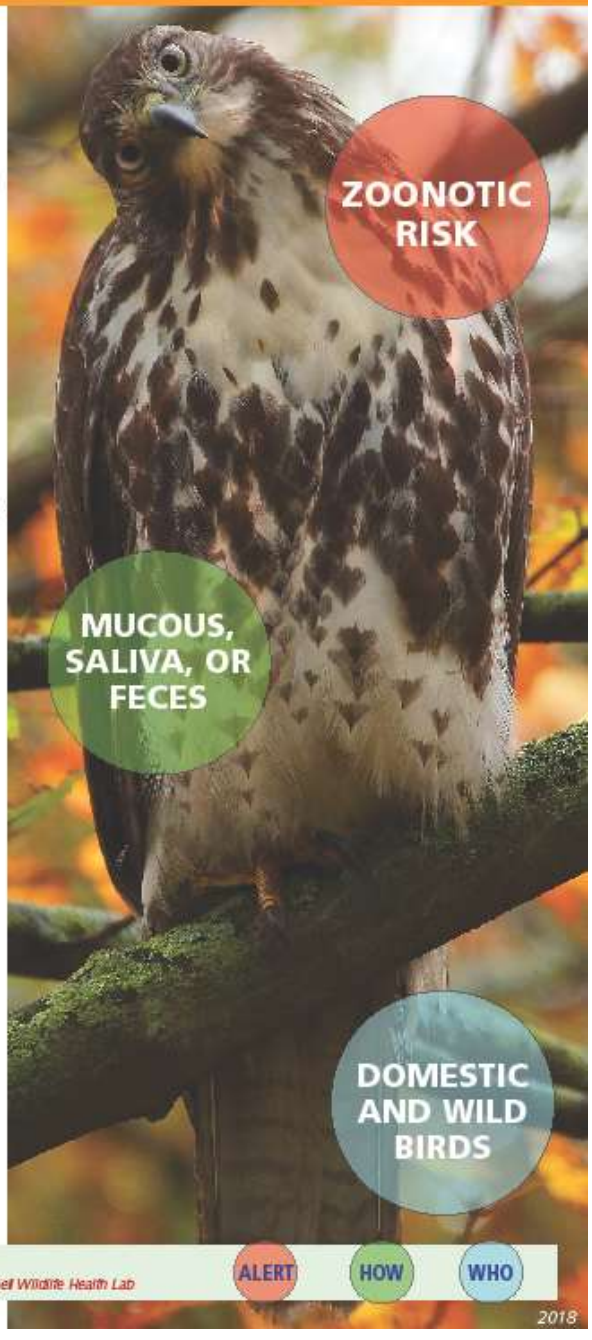
LPAI viruses cause **MILD RESPIRATORY SIGNS** such as sneezing, coughing, ocular and nasal discharge and occasionally swollen infraorbital sinuses in poultry. **SINUSITIS** is common in domestic ducks, quail and turkeys. In layers and breeders there is commonly decreased egg production and fertility.

HPAI viruses cause severe, systemic disease with **HIGH MORTALITY** in chickens, turkeys, and other gallinaceous poultry; mortality can be as high as 100% in a few days.

AI is **TRANSMITTED** between individual birds by ingestion or inhalation and betweeen farms by breaches in biosecurity practices. Infected birds shed avian influenza virus in their **SALIVA, MUCOUS, AND FECES.**

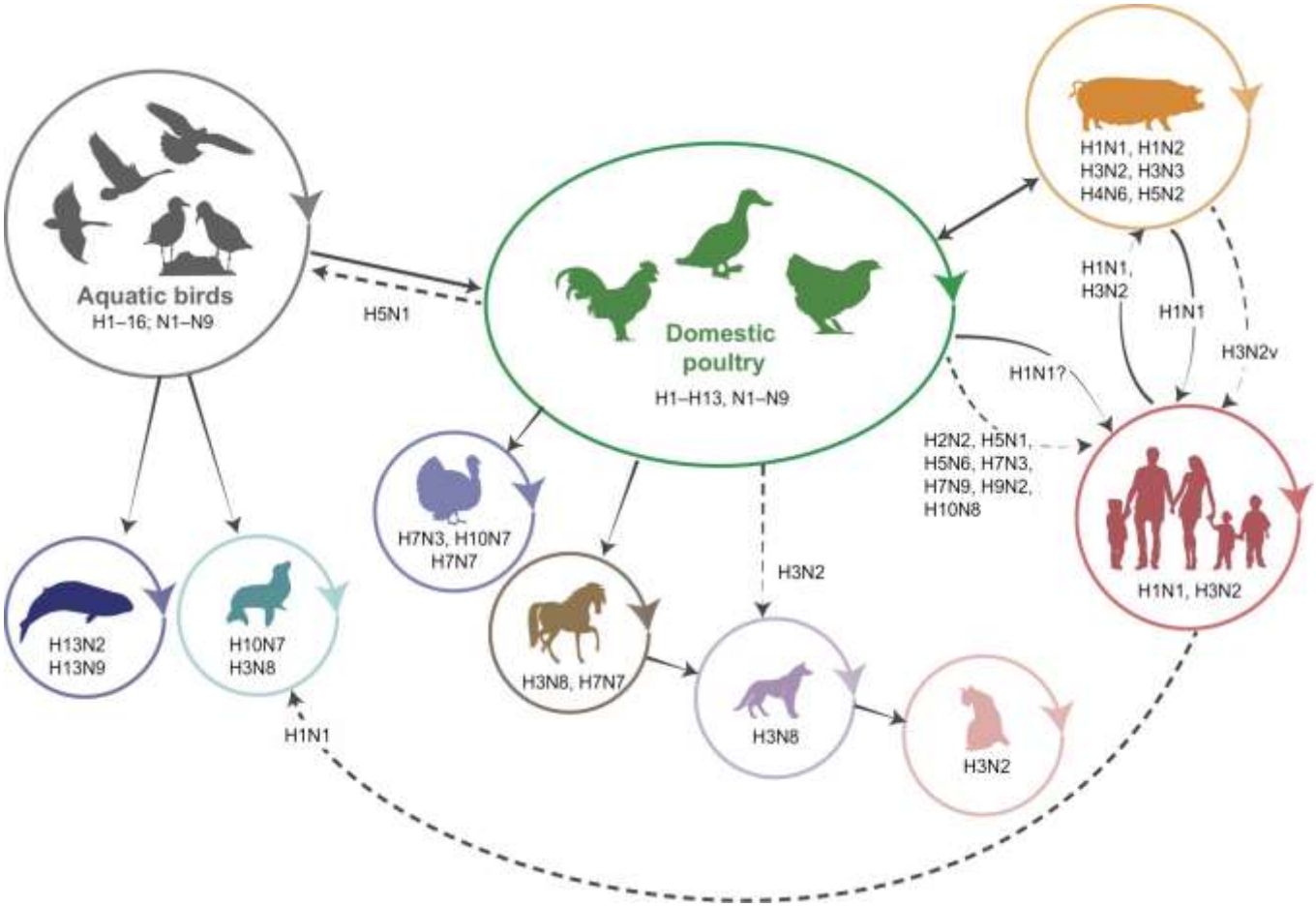
Both AI viruses can be **ISOLATED** from choanal and cloacal swabs, and HPAI viruses from many internal organs.

There is no effective **TREATMENT** for HPAI but depopulation can control the spread of the virus.



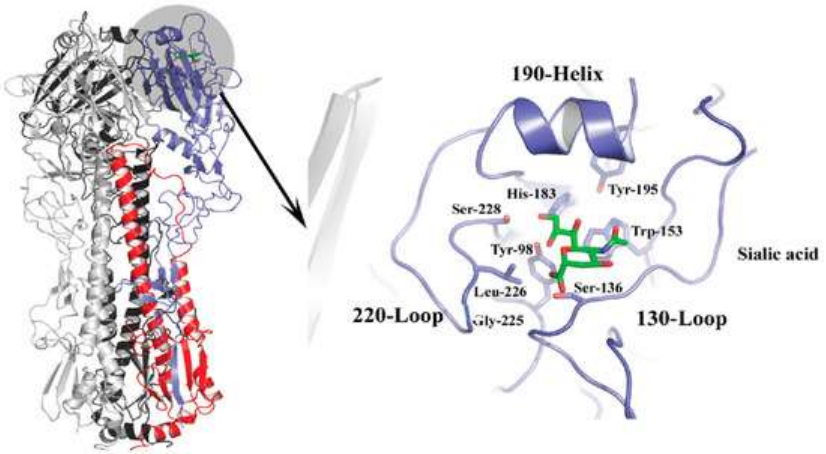

BIOSECURITY
FOR BIRDS

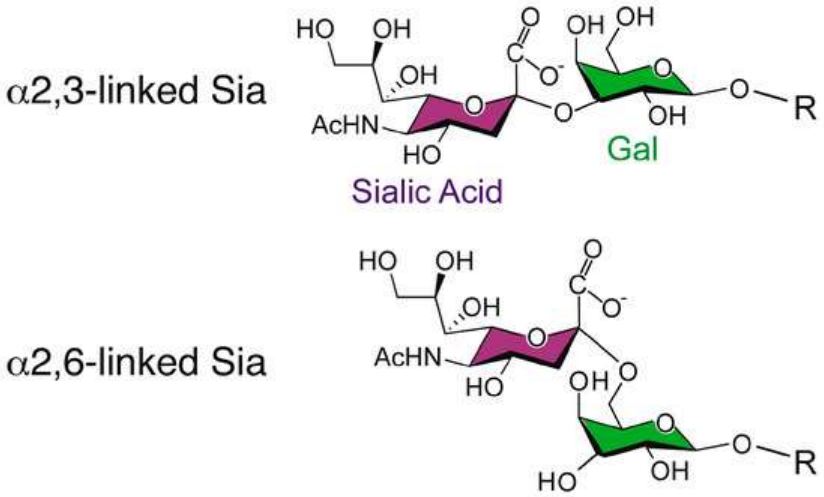
Influenza A viruses host range



Joseph et al., 2016 **https://doi.org/10.1111/irv.12412**

HA and cell receptors





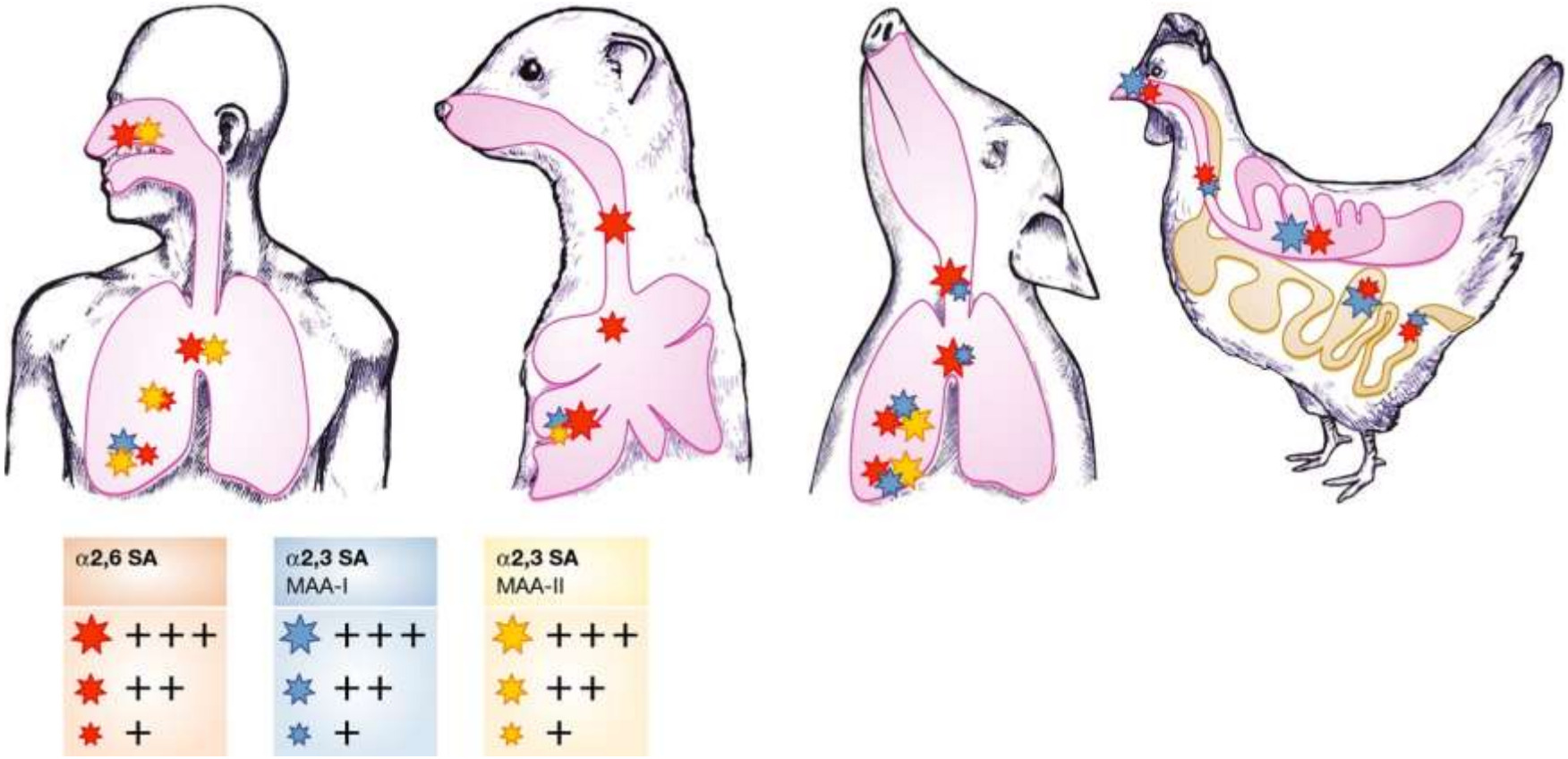
- The linkage of the sialic acid to the penultimate galactose is considered to be a determinant of species specificity

Gal = galactose

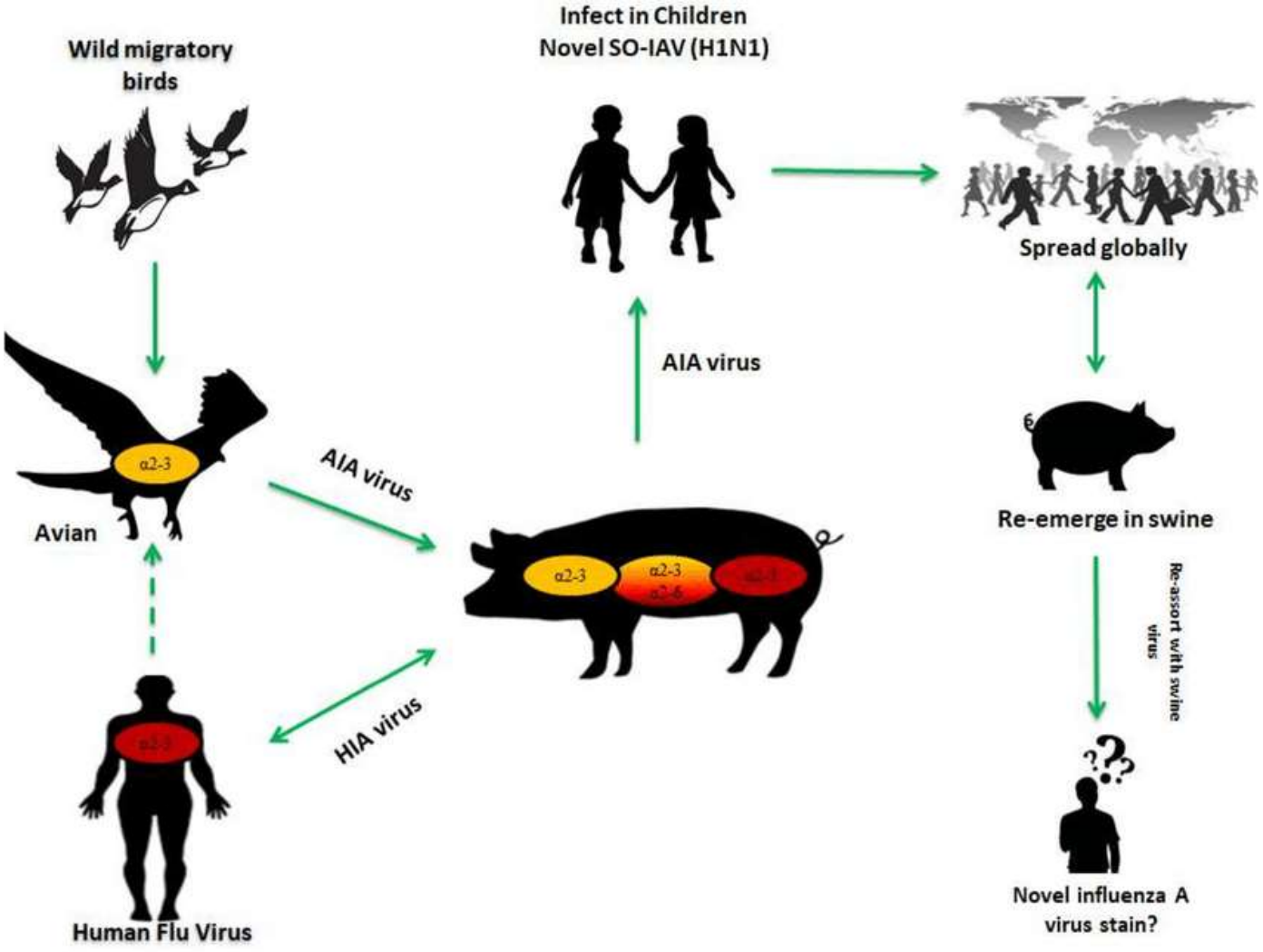
- Avian viruses characterized by binding α2,3-Sia and mammalian viruses by binding to α2,6-Sia

- Linkage preference, directed in part by structural features of the HA receptor binding pocket, is thought to correlate with receptor availability in the host

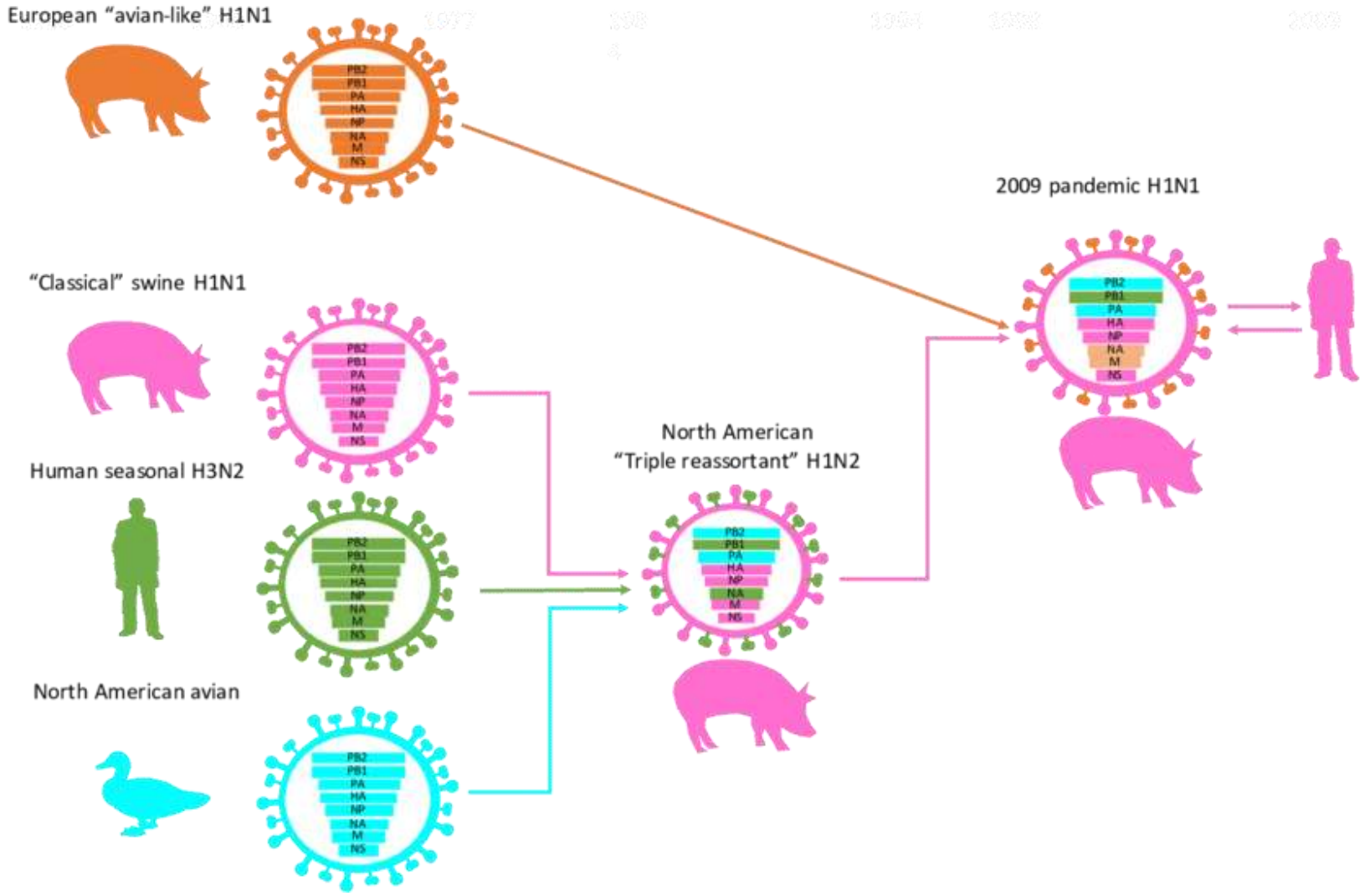
Distribution of α2,3 and α2,6 SA



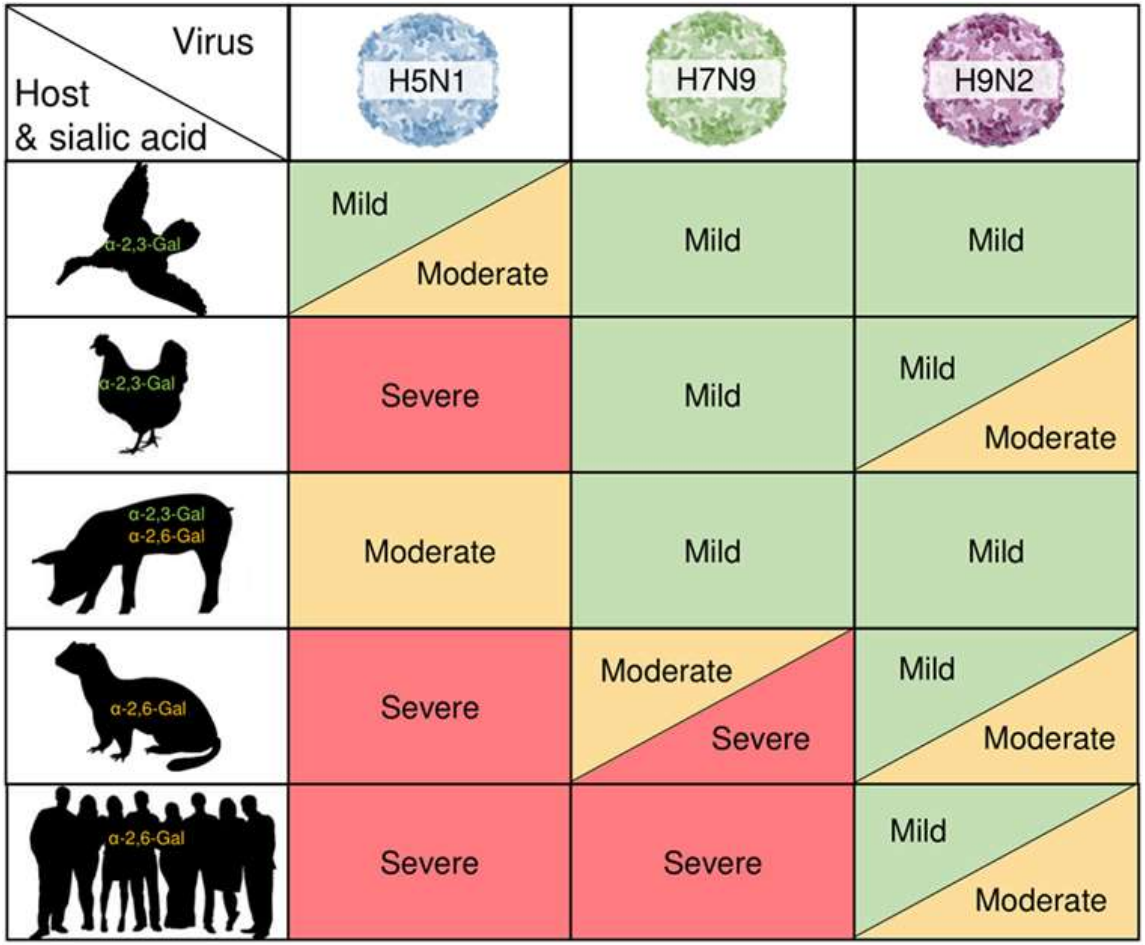
Swine as a mixing vessel and critical species on IA epidemiology



Example of 2009 H1N1 pandemic flu



HPAI types and host susceptibility



Horman et al., Front. Immunol., 08 August 2018 https://doi.org/10.3389/fimmu.2018.01812